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THE UNIVERSITY OF ALBERTA

UNIVERSITY TRANSPORTATION PREDICTION MODEL

by

© WILLIAM JOHN WILLIAMSON

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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ABSTRACT

The purpose of this thesis is to develop the transportation determinants necessary to predict the probable transportation requirements of The University of Alberta in one decade's time, complete with an assessment of the impacts and options. To assess future possible University generated travel demands, it has been necessary to establish the relationships between the University student generation, observed since 1965/1966 and the study parameters: population, income, high school enrolments, and age of subdivision. Examination of the age of subdivision parameter showed that major University student generation lags, or follows, the starting time of new city neighbourhoods by up to ten years, depending upon city area. School enrolment analysis showed that high school performance has a bearing on the University student generation. Income analysis showed that University Demographic Indices, by provincial region or city neighbourhood, also indicated that the student generation increased with income. University Social Indices, which demonstrate University participation rates of the related age groups of 15 to 24 years (federal census population), were used to predict future Albertan University students based on anticipated provincial and Edmonton population growth. To these Albertan students were added other Canadian foreign students, and the faculty and staff requirements, from which the total potential home to work trip generation was obtained. In this regard the likely city origins of the trip generation demand was assessed through study of city expansion plans.

Actual city-wide transportation mode choice and travel time data, received from students and staff via questionnaires administered since 1965/1966, form the basis of the transportation predictions. From this information the effects of portal to portal travel time difference on mode split was found to be the most reliable measure. Bus use and walk has increased in five years while the auto driver mode has decreased. However the use of public transit drops off sharply beyond a portal to portal travel time of 60 minutes for students and staff. From bus cordon counts and University parking records, the effects of bus service and parking supply on mode split were demonstrated. The University of Alberta is positively sensitive to improvements in public transit and there has been no significant quantitative shortage in campus parking places to 1970/1971. The travel time difference method of graphical campus mode split determination has shown unexplained positive curve progression between study years. Transportation correlations, analyses, and data demonstrated the good quality and reliability of thesis results.

Reliable estimations of future portal to portal travel time differences to the University were made, based upon observed travel times over five years. Future trip diversions to rapid transit were studied and assumed, and the major prediction problems were identified. Then with the analytical mode split methodology defined in addition to future home to work trip generation, future mode splits were estimated, without and with the use of the proposed Edmonton rapid transit system. The need for the University to handle 1,500 additional cars and double the number of buses resulted in the former case. Where as in the latter case, rapid transit would serve over 9,000 students and staff and substantially reduce campus parking and roadway space demands. This makes increased

campus densities more feasible.

Although essential, transportation service and facilities can also have an adverse effect on a desirable campus educational environment. The thesis therefore, concludes with an assessment of the possible transportation and environmental implications arising from the predictions.

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CHAPTER I

INTRODUCTION

1.1. General

The planning and provision of transportation facilities is a problem of mounting concern to virtually every major urban area in Canada. Unlike the past when cities were smaller and central areas less dense, cities of today have experienced substantial and rapid population growth, which commensurate with increased use of the automobile has made transportation needs increasingly diverse and complex to plan and provide for.

Because the overall city transportation problem has become very unmanageable to study and to solve in its entirety it has become, through necessity, common practice to examine transportation relevant to component city land uses which in total comprise the city.

This study therefore examines in depth the transportation needs of a major Canadian University being a public institutional land use component of the City of Edmonton. The fact that The University of Alberta is second only to the Central Business District as a traffic generation area is a situation unique to Edmonton, yet one which adds to the value of the research.

Because of the central problem of mounting concern for transportation planning and development of the city and therefore its constituent elements, a study which deals only with the present time would be of limited value. Thus of necessity this study has dealt with an examination of the transportation determinants necessary to predict the probable future transportation requirements of The University of Alberta, with sufficient lead time for appropriate consideration and possible action.

In this regard the university has recognized the need for such transportation planning before. In 1965 and again in 1967 Associated Engineering Services Limited performed a traffic and parking study (1, 2*) to suggest as to the university's needs. These reports still form much of the basis for ongoing campus transportation planning. The research at hand therefore carries on from the original start in many respects articulating new and changing transportation needs on the basis of more current information.

Prediction, of course, at a public educational institution involves the need to know the likely future size of the establishment, being a situation calling for research actually supportive to other forms of campus planning in addition to transportation. The general nature of this element of the research has been recognized and developed to prove up academic plans as much as possible with available resources. Research in this area therefore has been performed simply to add confidence of planning to the overall work. This research is certainly not

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* Please note: This method of designating the study references will be used throughout this thesis.

purported to be an academic plan. In essence the number of students is considered the major variable researched with faculty and staff numbers arrived at proportionately on the basis of students, thus arriving at a reliable population forecast.

1.2. Purpose of the Thesis

This research project has been designed to establish the transportation determinants necessary to predict the kinds (modes), amounts, and locations of transportation demands that will be placed on The University of Alberta and related City of Edmonton transportation services and facilities in one decade's time. In this regard a new mode of transportation, being rapid transit (13), may be in service towards the end of the decade under study and has thus been considered. The purpose of the thesis therefore is to establish the transportation determinants necessary to predict the transportation requirements of The University of Alberta by 1981/1982. Further, to use the resultant transportation determinants to *estimate* and then assess the *possible* transportation impacts upon the university area.

In order to do this research the following technical transportation elements have had to be assessed.

1. Student (and therefore, home to work trip) generation in relation to the selected parameters: population, income, age of subdivision, and school enrolments. Additionally, faculty and staff home to work trip generation in relation to students.

2. City residential locations of students and staff, 1965 to 1970, and residential land use in this regard one decade hence.
3. Modal split relationships of students and staff, 1965 to 1970, using the measures travel time, travel time ratio and travel time difference to identify the most relevant measure.
4. Travel times past, present, and future for the modes bus, car and walk.
5. The effect of travel time on mode split.
6. The effect of parking availability on mode split.
7. The effect of improvements in public transit on mode split.
8. The initial effectiveness of the proposed Edmonton rapid transit (13) on university generated travel demands.

In conducting the research project the chief source of data analyzed has been university origin-destination transportation studies 1965, 1966, 1967 and 1970, Statistics Canada, Statistics Alberta, the City of Edmonton, the Town of St. Albert and the County of Strathcona, The University of Alberta, including the Sociology Population Research Laboratory, the Alberta Universities Commission, the Department of Education, the Northern Alberta Institute of Technology and Grant MacEwen Community College.

1.3. Limitations of the Study

The three major limitations to this research project were (a) a moderate degree of uncertainty as to future transportation opportunities

and service characteristics (e.g. travel time) in Edmonton, (b) a degree of uncertainty as to the current enrolment situation of The University of Alberta (often abbreviated, U. of A.) therefore eluding to the difficulties of population forecasting, and (c) limitations to available research time.

In the case of the first limitation the City of Edmonton complete with citizen groups are currently reacting to a position paper (54) which will affect future transportation planning in Edmonton. As the outcome of this and subsequent rounds of planning will not be known for many months, appropriate assumptions have been necessary in this study.

With regard to the second limitation to the study, three facets are involved. Firstly the choice of parameters is all important in this type of research and there are no doubt ones other than those used which could be meaningful. Secondly there is great difficulty in obtaining the necessary data in the form required for this kind of research. Thirdly it was soon recognized that this form of population forecasting could become a thesis in itself. Thus concluding this limitation, suffice to say a new method of population forecasting has at least been conceived and tried and one which appears to have merit for further development.

In conclusion, although the time used in the research was expanded by many months, time availability still was a limitation.

1.4. Organization of the Thesis

The research project was conducted by first examining historic and current university student populations in light of the chosen

parameters, age of subdivision, income, population, and school enrolments. This was done on the basis of all Provincial University students, but for only University of Alberta students in the case of the City of Edmonton. Then on the basis of reliable parameter projections, future University of Alberta students were arrived at for one decade hence, and faculty and staff needs were then calculated out on a proportional basis from which the overall population projection was determined.

Next the historic and current mode splits of students and faculty and staff (henceforth called students and staff) were deduced in the most reproducible form by examining travel time zones, travel time ratio and travel time difference to arrive at the best measure.

Upon completion of this step future travel times for the City of Edmonton, with respect to The University of Alberta, were developed. Then on the basis of bus minus car, and walk minus car, travel time differences, and predicted student and staff populations complete with city residential distributions, and future mode splits were determined.

The concluding portion of the research project was to then draw a comparison of the predicted and assumed university mode split without, and with, respectively, use of the proposed Edmonton Rapid Transit System (13), for the purpose of assessing the probable impact or terminal problem of future student and staff transportation on The University of Alberta. This leads to the conclusions and recommendations of the investigations.

CHAPTER II

POPULATION FORECAST

2.1. General

This chapter of the report is concerned with arriving at a reliable student and staff population projection in order that transportation recommendations inherent in the research are sound. As such, a detailed analysis of available historic data leading to an institutional population forecast is herein described. Because of the nature of the parameters selected for the research, and the residential land use facet of past transportation studies, it has been possible to perform a very different type of population projection than available heretofore.

TABLES II-1 and II-2, which follow, indicate recent student and staff growth at The University of Alberta to 1972/1973 and 1970/1971 respectively, thus setting population forecasting into immediate perspective.

2.2. Analysis of Historic Data

2.2.1. Province of Alberta

2.2.1.(a) School Enrolments

Historic provincial school enrolments and high school performance were examined in detail on the basis of information supplied by the Office of Operational Research, Alberta Department of Education (38).

TABLE II-1

THE UNIVERSITY OF ALBERTA

HISTORIC STUDENT ENROLMENT**

Academic Winter Session	Full-Time Day Students	Part-Time Day Students	Total Day Students
1960/61	6,381	*	--
1961/62	6,562	*	--
1962/63	7,356	*	--
1963/64	8,091	*	--
1964/65	9,334	*	--
1965/66	10,233	618	10,851
1966/67	11,464	740	12,204
1967/68	12,992	884	13,876
1968/69	15,293	926	16,219
1969/70	17,342	1,002	18,344
1970/71	18,337	1,183	19,520
1971/72	18,237	1,257	19,494
1972/73	17,837	1,362	19,199

* NOTE: Records kept on different basis.

** Source: Ref. 36.

TABLE II-2

THE UNIVERSITY OF ALBERTA

RECENT FACULTY AND STAFF**

Academic Year	Full-Time Staff	Part-Time Staff (F.T.E.)*	Total F.T.E.* Staff
1965-1966	2,497	996	3,493
1966-1967	2,915	885	3,800
1967-1968	3,346	881	4,227
1968-1969	3,880	929	4,809
1969-1970	4,484	1,110	5,594
1970-1971	4,778	944	5,722

* PLEASE NOTE: All students have been eliminated from the Full-Time Equivalent (F.T.E.) of the part-time staff to avoid any duplication.

** Source: The University of Alberta Payroll Statistics.

TABLE II-3 shows an analysis of provincial matriculants and entering university freshmen as a percent of the related grade 1 beginning class, 11 years earlier. The percentage of freshmen enrolments at Alberta Universities as a percent of the related grade 1 class has increased from 10% in the mid fifties to 29.67% by 1968/1969. Since this time the percent has fallen to 27.48% in 1969/70 and 24.11% in 1970/1971. The recent drop in freshmen university enrolments to 7,925 and 7,382 from 8,020, has been absolute in terms of numbers, yet the related grade 1 beginning classes, 11 years earlier, showed increases.

At this point in the analysis an examination of grade 12 performance (38) shows what may have contributed in part to the declining provincial university freshman enrolments.

The following definitions and explanations will be required in interpreting the following table:

Condition A-- English 30 and Social Studies 30 plus four other examination subjects.

Average based on the six examination subjects--60% or better.

Condition B-- English 30 plus four other examination subjects.

Average based on the five examination subjects--60% or better.

Condition C-- English 30 plus three other examination subjects plus one non-examination subject.

Average based on the five subjects--60% or better.

Condition D-- English 30 plus three other examination subjects plus one non-examination subject.

Average based only on the four examination subjects--60% or better.

TABLE II-3

ALBERTA GRADE 12 ENROLMENT AND NUMBER OF DIPLOMAS AND MATRICULANTS COMPARED TO NUMBER OF STUDENTS WHO ENTERED GRADE 1 ELEVEN YEARS PREVIOUS*

GRADE I BEGINNERS		GRADE XII ENROLMENT[1]			DIPLOMATES[2]		MATRICULANTS[2]		FRESHMEN ENROLMENTS (FALL)			
Year	No. of Students	Year	No. of Students	% of Corr. Grade I Class	No. of Diplomas	% of Corr. Grade I Class	No. of Matrics.	% of Corr. Grade I Class	U. of Alta U. of Calg. U. of Leth.	% of Corr. Grade I Class	Jr. Colleges[3] U. of Alta., U. of Calg., U. of Leth.	Total % of Corr. Gr. I Class
1936	23,689	1946-47	6,313	26.65	2,587	10.92	-					
1937	24,387	1947-48	6,302	25.84	2,710	11.11	-					
1938	23,660	1948-49	6,179	26.12	2,806	11.86	967	4.09				
1939	21,475	1949-50	6,258	29.14	2,871	13.37	978	4.55				
1940	20,590	1950-51	6,239	30.30	2,829	13.74	946	4.59				
1941	20,125	1951-52	6,158	30.60	3,055	15.18	1,024	5.09				
1942	20,086	1952-53	6,217	30.95	3,074	15.30	1,098	5.47				
1943	19,006	1953-54	6,345	33.38	3,681	19.37	1,237	6.51				
1944	18,495	1954-55	6,884	37.22	3,867	20.91	1,426	7.71				
1945	15,846	1955-56	7,320	46.19	4,161	26.26	1,458	9.20	1,620	10.22	-	10.22
1946	16,353	1956-57	7,723	47.23	4,313	26.37	1,668	10.20	1,829	11.18	1,854	11.34
1947	16,557	1957-58	8,456	51.07	4,703	28.40	1,874	11.32	2,040	12.32	2,092	12.64
1948	17,486	1958-59	9,724	55.61	5,204	29.76	2,121	12.13	2,161	12.36	2,229	12.75
1949	18,761	1959-60	11,291	60.18	5,934	31.63	2,502	13.34	2,410	12.85	2,494	13.29
1950	20,451	1960-61	13,223	64.66	6,715	32.83	3,202	15.66	2,846	13.92	3,012	14.73
1951	20,236	1961-62	14,160	69.97	7,570	37.41	3,492	17.26	3,131	15.47	3,298	16.30
1952	20,980	1962-63	14,692	70.03	7,792	37.14	3,710	17.68	3,051	14.54	3,268	15.58
1953	23,781	1963-64	16,697	70.21	9,112	38.32	4,213	17.72	3,310	13.92	3,720	15.64
1954	26,201	1964-65	20,172	76.99	11,304	43.14	4,588	17.51	3,393	12.95	3,989	15.22
1955	24,519	1965-66	21,781	88.83	14,535	59.28	5,392	21.99	4,128	16.84	4,959	20.23
1956	25,459	1966-67	21,970	86.30	15,221	59.79	6,886	27.05	5,544	21.78	6,274	24.64
1957	25,673	1967-68	22,484	87.58	15,920	62.01	7,819	30.46	6,391	24.89	7,137	27.80
1958	27,034	1968-69	25,227	93.32	17,674	65.38	7,910	29.26	8,020	29.67		
1959	28,834	1969-70	27,138	94.12	18,151	62.95	7,787	27.01	7,925	27.48		
1960	30,617	1970-71	28,793	94.04	18,946	61.88	7,955	25.98	7,382	24.11		

[1] Grade XII enrolments include students registered in the first year of Grade XII and students registered in the second year of a two-year Grade XII program.

[2] Figures include students studying under adult privileges.

[3] Camrose Lutheran College, Lethbridge Junior College, Mount Royal Junior College, Red Deer Junior College, Grande Prairie Junior College and Medicine Hat Junior College.

* Source: Operational Research Branch, Department of Education, Alberta.

TABLE II-4 showing the 60% average or better portion of recent grade 12 performance shows that the percent of successful candidates has fallen from 69.8% to 60.1%. In addition to this trend January matriculants have increased to 870 in 1971 and may not be as readily available to attend University by September as June candidates. Grade 12 completions in one year for 60% plus averages, dropped from 85.5% to 75.2% and the related student grades performance fell fractionally in relation to 1970 and 1969. Other special condition students who may be possible University candidates (Ref. APPENDIX I) were not included in the observations above as no basis was found to be as sure of their eligibility as those with averages clearly 60% or better. Their numbers present a constant recent trend. Thus in summary it appears grade 12 performance has had a slight decrease and students with 50% or less averages have increased and tended to stay in school longer (Ref. APPENDIX I).

Condition A through D, possible University candidates for 1968/1969, 1969/1970 and 1970/1971 were also analyzed on a provincial geographic zone basis by Operational Research, which yields considerable insight into University enrolment success.

To further this geographic analysis, all Alberta University students were summarized on the Operational Research Geographic Basis as shown on FIGURE 2.1 and TABLE II-5. Then actual University enrolments of this table were compared with Operational Research data of possible University candidates per geographic zone (Ref. APPENDIX I) to arrive at TABLE II-6 which emphasizes the ratio of the two measures, defined as the U-Factor. As in the case of zones 2 and 3, most relevant to The University of Alberta, a division of data could

TABLE II-4

RECENT ACHIEVEMENTS OF GRADE 12 STUDENTS, ALBERTA*

AVERAGES	60-69%			70-79%			80%+			TOTALS		
	1**	2***	Total	1**	2***	Total	1**	2***	Total	1**	2***	
1969 POSSIBLE UNIVERSITY CANDIDATES												
Condition A	1,516	281	1,797	1,110	90	1,200	412	20	432	3,038	391	3,429
Condition B	1,675	407	2,082	572	46	618	184	12	196	2,431	465	2,896
Condition C	257	212	469	46	13	59	12	2	14	315	227	542
Condition D	6	10	16	-	-	-	-	-	-	6	10	16
	3,454	910	4,364	1,728	149	1,877	608	34	642	5,790	1,093	6,883
% Successful in First Year Grade 12 - 84.1%										Non-departmental Matriculants		249
										Successful Candidates		7,132 - 69.8%
										Total Candidates		10,213
1970 POSSIBLE UNIVERSITY CANDIDATES												
Condition A	1,050	161	1,211	805	52	857	276	14	290	2,131	227	2,358
Condition B	1,964	396	2,360	872	58	930	211	9	220	3,047	463	3,510
Condition C	312	232	544	103	22	125	15	3	18	430	257	687
Condition D	7	6	13	-	-	-	-	-	-	7	6	13
	3,333	795	4,128	1,780	132	1,912	502	26	528	5,615	953	6,568
% Successful in First Year Grade 12 - 85.5%										Non-departmental Matriculants		520
										Successful Candidates		7,088 - 62.8%
										Total Candidates		11,287
1971 POSSIBLE UNIVERSITY CANDIDATES												
Condition A	865	272	1,137	565	204	769	193	84	277	1,623	560	2,183
Condition B	1,889	573	2,462	771	175	946	177	74	251	2,837	822	3,659
Condition C	696	330	1,026	144	32	176	16	4	20	856	366	1,222
Condition D	9	12	21	-	-	-	-	-	-	9	12	21
	3,459	1,187	4,646	1,480	411	1,891	386	162	548	5,325	1,760	7,085
% Successful in First Year Grade 12 - 75.2%										January Matriculants		870
										Successful Candidates		7,955 60.1%
										June Successful Candidates		7,085 -
										Total Candidates		13,245

** Students Completing Grade 12 in one year.
*** Students completing Grade 12 in at least two years.

* Source: Ref. 38.

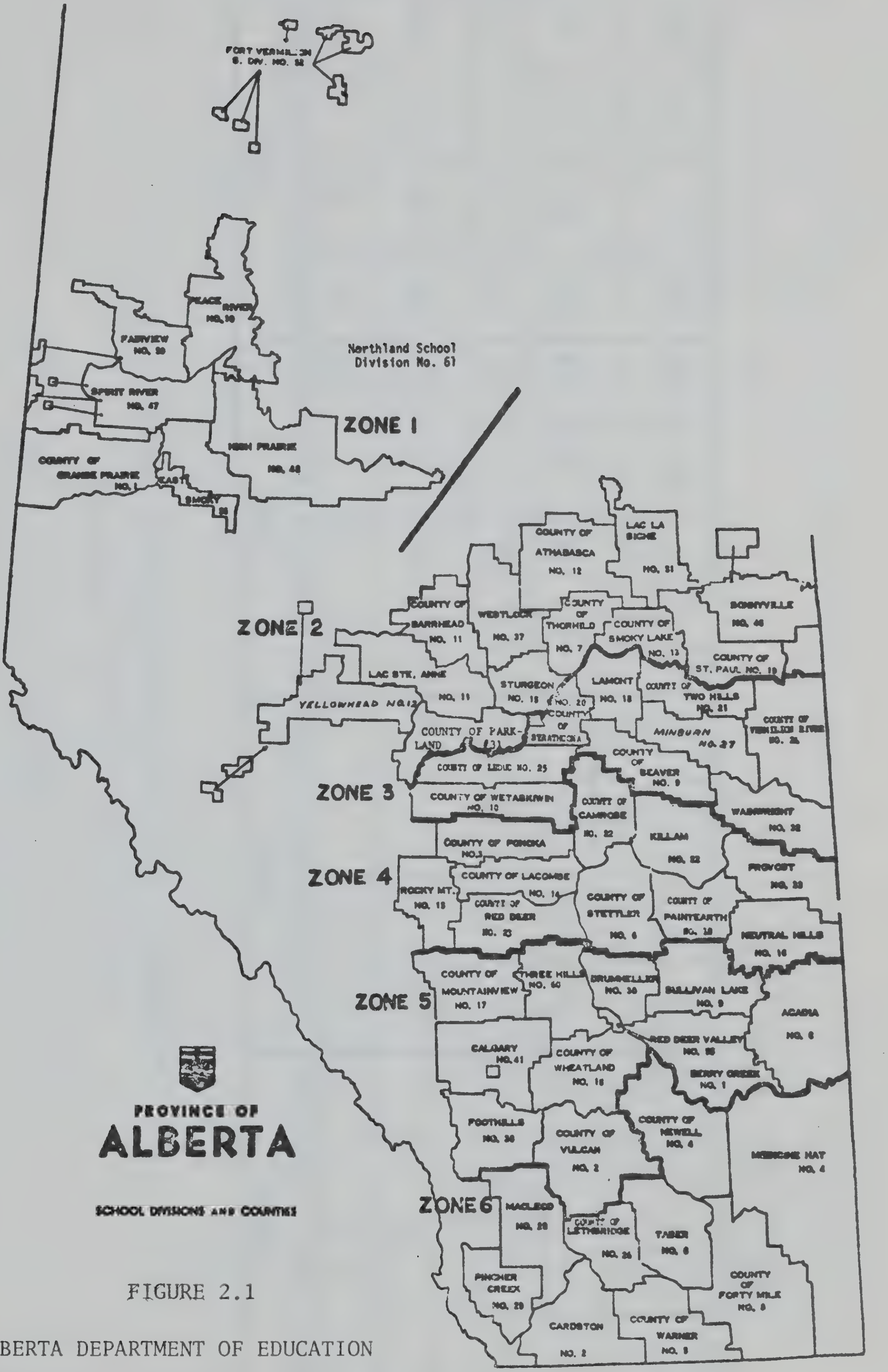


FIGURE 2.1

ALBERTA DEPARTMENT OF EDUCATION
OPERATIONAL RESEARCH, STUDENT ANALYSIS ZONES

TABLE II-5

FULL-TIME ALBERTAN UNIVERSITY STUDENTS BY DEPARTMENT OF EDUCATION OPERATIONAL RESEARCH ZONES*

	1968/69				1969/70				1970/71				1971/72			
ZONE	U of A	U of C	U of L	Total	U of A	U of C	U of L	Total	U of A	U of C	U of L	Total	U of A	U of C	U of L	Total
1	424	22	1	447	446	24	3	473	469	40	6	515	422	36	4	426
2 3	10500	127	17	10644	12513	99	17	12629	13353	220	14	13587	13344	222	33	13599
4	941	171	18	1130	914	171	15	1100	916	225	16	1157	849	209	10	1068
5	990	5497	31	6518	992	6340	42	7374	995	7243	43	8281	992	7217	42	8251
6	591	425	897	1913	628	455	1108	2191	607	587	1262	2456	578	543	1082	2203
TOTAL	13446	6242	964	20652	15493	7089	1185	23767	16340	8315	1341	25996	16185	8227	1171	25583

* Source: Refs. 35, 36, 37.

TABLE II-6

RATIO ALBERTAN UNIVERSITY STUDENT ENROLMENT TO POSSIBLE CANDIDATES* BY OPERATIONAL RESEARCH GEOGRAPHIC ZONES**

Education Zones & Notes	Possible University Candidates				Full Time Alberta Student Enrolment				U-Factor
	68/69	69/70	70/71	Total 1	U of A	U of C	U of L	Total 2	$\frac{\text{Total 2}}{\text{Total 1}}$
1	234	237	267	738	422	36	4	462	0.63
2 + 3 Less Metro Edmonton	1128	1048	1043	3219	232	72	15	2408	0.75
4	665	655	633	1953	849	209	10	1068	0.55
5 Less Metro Calgary	431	413	396	1240	218	507	24	749	0.60
6	756	583	594	1933	578	543	1082	2203	1.14
Metro Edmonton	2117	1905	2198	6220	11023	150	18	11191	1.80
Metro Calgary	1768	1689	1724	5181	774	6710	18	7502	1.45
Provincial Total	7099	6530	6855	20484	16185	8227	1171	25583	1.25

* Averages 60% or better.

** Source: Refs. 35, 36, 37, 38.

not be made, the single, larger zone, 2 plus 3, was used. In point of fact the overall estimation of Alberta University students per zone is a rough approximation, yet, quite accurate enough to show a disproportionate provincial high school to university picture.

Naturally it would have been entirely desirable to have found the comparable ratio based on four or more years grade 12 school data if it had been available. Consideration of the special condition A through D students (Ref. APPENDIX I) does not substantially alter the relative relationship amongst the regional U-Factors.

An examination of TABLE II-6 shows that zone 4 through Red Deer and Central Alberta has the lowest U-Factor thus being the zone of greatest potential to university enrolment. The Peace River Block with a U-Factor of 0.63 has substantial student potential, of particular interest to The University of Alberta historically. Zone 5 less Metro. Calgary has a low U-Factor of particular interest to The University of Calgary. The U-Factor for zones 2 plus 3 less Metro. Edmonton, most relevant to The University of Alberta, indicates higher realization of enrolment potential than for zone 5 less Metro. Calgary. Metropolitan Edmonton and Calgary have the highest U-Factors identified indicating the greatest realization of university potential student enrolment. Zone 6, which includes the new University of Lethbridge, has a U-Factor below the provincial average as could be expected.

In conclusion the analysis indicates that the recent interruptions to the normal growth of Alberta University freshmen enrolments is due in part to recent high school performance (38). Additionally, it is apparent in the U-Factor research that Calgary and Edmonton, being large urban areas, generate more university students per measure of

qualified students available. The brief analysis therefore has a definite bearing on the study from the point of view the recent sagging university enrolment phenomena, to present geographically differentiated university student potentialities. It will be shown that when these factors are weighed with provincial income a strong pattern emerges.

2.2.1.(b) Provincial Population

As any planning concerning university students is very much a part of demographic analysis, provincial population trends were analyzed as one prominent parameter to the study. From the 1956, 1961, 1966, and 1971 Census of Canada (19, 20, 21, 44), provincial population was summarized on the basis as shown in TABLE II-7, with census divisions defined as per FIGURE 2.2. From this analysis the population characteristics found to be most relevant to university enrolment were identified and trends in age groups and totals are evident upon examination of the figures.

Then on the basis of the Alberta census divisions, all provincial Albertan University students were summarized from Registrar's statistics (35, 36, 37) for the census years 1961, 1966 and 1971 as shown on TABLE II-8. This was done for the purpose of comparison of actual Albertan University students and related Alberta population groups per census division. Again, as for TABLE II-7, university enrolment trends shown in TABLE II-8 are evident and most interesting.

Having thus summarized provincial population by age groups and university students it was possible to experiment with graphical relationships which ultimately showed, that of readily available census data, the 15 to 24 age group is not related to university enrolment experience as seen by similiarity in curve slopes (Ref. APPENDIX I).

TABLE II-7

PROVINCE OF ALBERTA POPULATION CHARACTERISTICS

FROM LAST FOUR CENSUS OF CANADA*

CENSUS DIVISIONS	AGE 1956				AGE 1961				AGE 1966				AGE 1971			
	0-14	15-24	15-34	All	0-14	15-24	15-34	All	0-14	15-24	15-34	All	0-14	15-24	15-34	All
1	10979	4793	9851	34496	13278	5429	10588	39140	12581	5851	10254	38858	11332	6828	11064	39149
2	25587	11160	21618	74991	29284	12325	23014	83306	28230	13235	22254	82719	26451	16433	26179	86624
3	10970	4729	8647	30426	11591	4694	8241	30967	10796	4725	7594	29592	10326	5643	9011	30940
4	4715	1871	3910	14294	5374	1989	3817	15020	5023	2118	3574	14224	4176	2216	3558	12991
5	13238	4864	9723	38120	13328	5351	9675	38115	12259	5528	9041	35987	10812	5969	9660	34485
6	72057	32719	74363	237886	107538	42449	94971	317989	124935	57028	109176	369140	137215	84503	150812	447079
7	14003	5350	10568	40214	14648	5395	10138	40837	14241	6212	10331	40833	11695	6542	10555	38334
8	21658	9189	17687	64168	26973	11251	20832	76533	29402	13443	23096	83912	27141	15425	25410	85638
9	5191	2219	4873	17239	6174	3013	6121	20274	5673	2911	4970	18195	5806	3872	6379	19781
10	23855	10064	18854	71500	23248	9796	17383	70177	22787	10460	17300	70211	19286	10423	16796	65532
11	104788	48737	105764	323539	144579	58466	124177	410679	165345	77941	144132	476053	171924	108201	188738	552461
12	17370	7657	13423	44947	19105	7271	13017	47310	20664	7735	13924	50635	21271	9240	15975	54647
13	15916	6338	11812	45033	16221	6162	11350	45431	15493	6384	10734	44142	14232	6968	11268	43786
14	5302	2380	4851	15846	7333	2796	5774	19282	7901	3019	5813	20358	7887	3774	6707	21665
15	27006	11258	20859	70417	30650	11771	21631	76884	35436	14414	25492	88344	34952	17115	29705	94762
TOTAL	372835	163328	336803	1123116	469344	188158	380729	1331944	510766	231004	417685	1463203	514506	303152	521817	1627874

* Source: Refs. 19, 20, 21, 44.

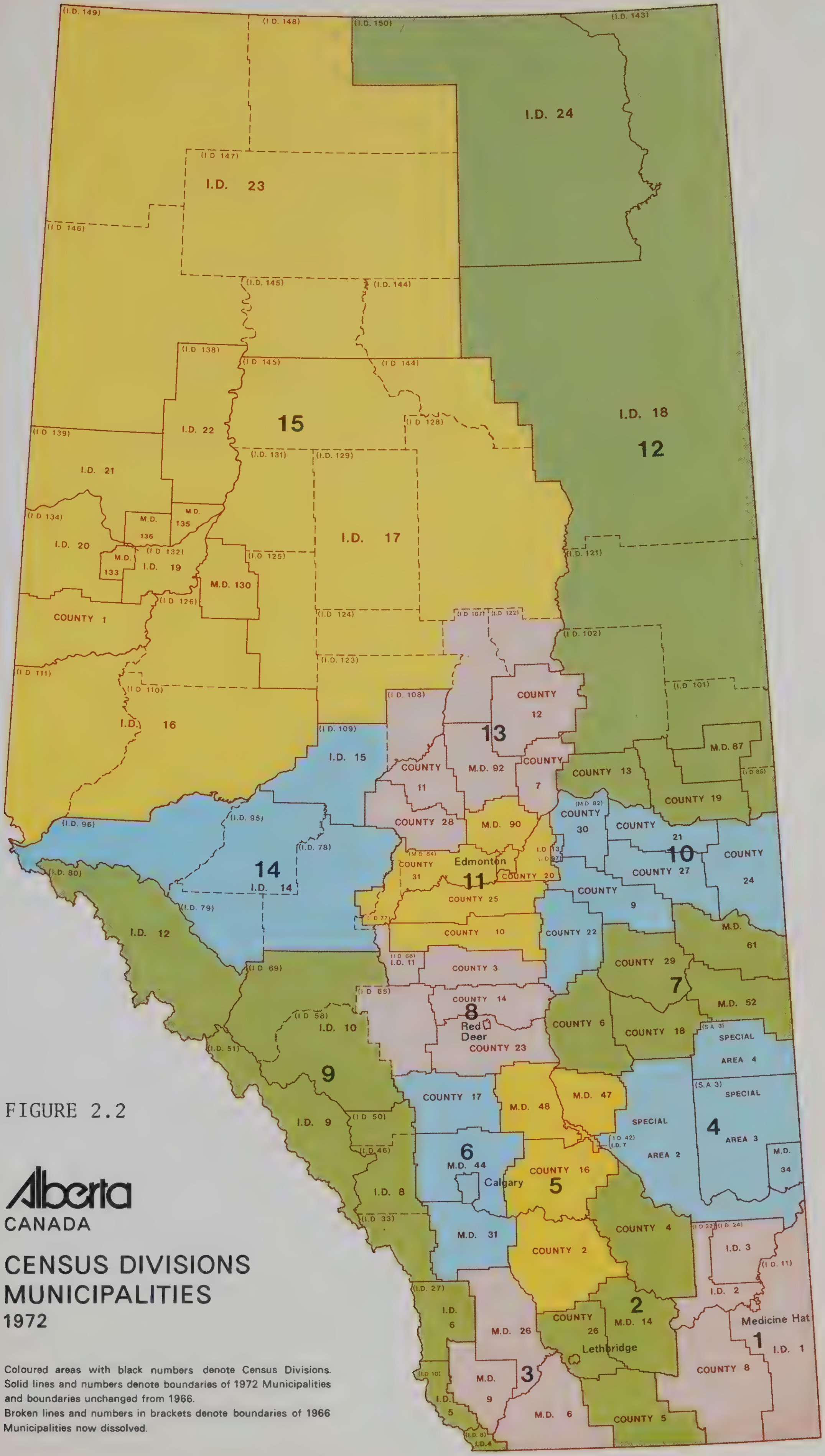


FIGURE 2.2

Alberta
CANADA

CENSUS DIVISIONS
MUNICIPALITIES
1972

Coloured areas with black numbers denote Census Divisions.
Solid lines and numbers denote boundaries of 1972 Municipalities and boundaries unchanged from 1966.
Broken lines and numbers in brackets denote boundaries of 1966 Municipalities now dissolved.

TABLE II-8

ALBERTAN UNIVERSITY STUDENTS IN FEDERAL CENSUS YEARS BY CENSUS DIVISIONS AND UNIVERSITY *

CENSUS DIVISION	1961-1962						1966-1967						1971-1972							
	U. OF A.		U. OF C.		TOTAL STUDENTS		U. OF A.		U. OF C.		TOTAL STUDENTS		U. OF A.		U. OF C.		U. OF L.		TOTAL STUDENTS	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
1	97	70.8	40	29.2	137	100	107	57.2	80	42.8	187	100	136	38.2	159	44.7	61	17.1	356	100
2	326	93.9	21	6.1	347	100	366	66.6	184	33.4	550	100	320	23.1	168	12.1	895	64.8	1383	100
3	80	90.9	8	9.1	88	100	96	53.9	82	46.1	178	100	95	30.4	109	34.9	108	34.7	312	100
4	33	91.7	3	8.3	36	100	40	83.3	8	16.7	48	100	29	18.5	126	80.3	2	1.2	157	100
5	58	73.4	21	26.6	79	100	72	34.0	140	66.0	212	100	56	20.0	211	75.4	13	4.6	280	100
6	605	33.0	1229	67.0	1834	100	821	21.0	3097	79.0	3918	100	891	11.4	6900	88.3	27	0.3	7818	100
7	163	97.6	4	2.4	167	100	219	95.6	10	4.4	229	100	198	83.5	35	14.8	4	1.7	237	100
8	296	90.5	31	9.5	327	100	401	81.2	93	18.8	494	100	488	73.5	170	25.6	6	0.9	664	100
9	66	84.6	12	15.4	78	100	74	68.5	34	31.5	108	100	65	37.4	91	52.3	18	10.3	174	100
10	426	99.3	3	0.7	429	100	629	98.6	9	1.4	638	100	732	96.4	20	2.6	7	1.0	759	100
11	3710	99.3	28	0.7	3738	100	6363	99.6	25	0.4	6388	100	11961	98.5	162	1.3	22	0.2	12145	100
12	164	100	0	0	164	100	239	99.6	1	0.4	240	100	334	96.0	11	3.2	3	0.8	348	100
13	151	100	0	0	151	100	230	99.1	2	0.9	232	100	318	94.4	18	5.3	1	0.3	337	100
14	57	95.0	3	5.0	60	100	86	98.9	1	1.1	87	100	140	92.7	11	7.3	0	0.0	151	100
15	268	97.8	6	2.2	274	100	361	98.9	4	1.1	365	100	422	91.3	36	7.8	4	0.9	462	100
TOTAL	6500	82.2	1409	17.8	7909	100	10104	72.8	3770	27.2	13874	100	16185	63.3	8227	32.2	1171	4.5	25583	100

* Source: Refs. 35, 36, 37.

Next, ratios of total provincial Albertan university students (Ref. TABLE II-8) divided by age 15 to 24 populations (Ref. TABLE II-7), per federal census year and Alberta census division, were calculated as shown on TABLE II-9. A complete set of ratios for a given census year are defined as "University Social Indices", and in total yield considerable insight into provincial university student generation. Such indices as these are the main input to student generation projections for the demographic projection technique. The above list of University Social Indices for three federal census years (Ref. TABLE II-9) is more comprehensive than any such list found to date. Other reports, such as Seastone (42), call these or similar indices Participation Rates, and University Social Index can be the same thing if so defined.

Examples of the meaning of the University Social Indices will have merit. In census division 11 which includes Metropolitan Edmonton the University Social Index of 0.12145 indicates that 11.22% equivalent of the related 15 to 24 age group were attending three Alberta universities in 1971, with 98.5% of them at The University of Alberta (Ref. TABLE II-8). In total in 1971/1972, 8.44% equivalent of the related 15 to 24 age group were enrolled in Alberta universities as shown in TABLE II-9. As the above discussed participation rates say nothing of those students greater than 24 years and include 15 year olds of which none are currently enrolled in Alberta universities, it must be understood that the rates are but an equivalent estimation method. The forte of the so-called "University Social Indices", however, lies in the insight such a method yields into university student participation rates, imbalances per census divisions and individual university enrolment success for the province of Alberta.

TABLE II-9

UNIVERSITY SOCIAL INDICES - RATIO OF ALBERTAN UNIVERSITY STUDENTS

TO AGE 15 TO 24 CENSUS POPULATION GROUP

CENSUS DIVISION	1961-62		UNIVERSITY SOCIAL INDEX	1966-67		UNIVERSITY SOCIAL INDEX	1971-72		UNIVERSITY SOCIAL INDEX
	STUDENTS	POPULATION		STUDENTS	POPULATION		STUDENTS	POPULATION	
1	137	5429	.02523	187	5851	.03196	356	6828	.05214
2	347	12325	.02815	550	13235	.04156	1383	16433	.08415
3	88	4694	.01875	178	4725	.03767	312	5643	.05529
4	36	1989	.01810	48	2118	.02266	157	2216	.01085
5	79	5351	.01476	212	5528	.03835	280	5969	.04690
6	1834	42449	.04321	3918	57028	.06870	7818	84503	.09252
7	167	5395	.03095	229	6212	.03686	237	6542	.03623
8	327	11251	.02906	494	13443	.03675	664	15425	.04305
9	78	30.3	.02589	108	2911	.03710	174	3872	.04494
10	429	9796	.04379	638	10460	.06099	759	10423	.07282
11	3738	58466	.06393	6388	77941	.08196	12145	108201	0.11224
12	164	7271	.02256	240	7735	.03103	348	9240	.03766
13	151	6162	.02451	232	6384	.03634	337	6968	.04836
14	60	2796	.02146	87	3019	.02882	151	3774	.04001
15	274	11771	.02328	365	14414	.02532	462	17115	.02699
TOTAL ALBERTA	7909	188158	.04203	13874	231004	.06006	25583	303152	.08439

The meaning of the above student and demographic analysis will now be discussed. Broadly speaking TABLE II-8 shows The University of Alberta is losing enrolment in Southern Alberta due to the location of two newer universities in that area. Part of this loss in enrolment is absolute and part is relative to a decreased share of university students. On the basis of available data and logic it can be safely assumed that at least the loss on a relative share basis trend will continue. As could have been predicted, however, Southern Alberta, from 1961 to 1971, has experienced a great growth in university students chiefly benefiting the Universities of Calgary and Lethbridge as evidenced by the University Social Indices of TABLE II-9.

In Central and Northern Alberta, census divisions 7 through 15, although university enrolments have more than doubled university social index growth has been relatively low in many cases and thus not as large as index growth in the south of the province. The Peace River Block Index grew, for example, from .02328 to .02699 from 1961 to 1971 (Ref. TABLE II-9 Census Division 15), again indicating as in the previous U-factor analyses that the university student potential of the area is not being fully realized. Growth in the Edmonton area census division 11 has of course been spectacular and the University Social Index has doubled in 10 years.

Concluding the provincial demographic analysis it is evident, throughout, that provincial population growths or shifts, such as the process of urbanization, will have a marked effect on Alberta University student participation rates via use of the appropriate geographic based University Social Index. Future projections must account for such trends.

2.2.1.(c) Provincial Income

In any study of a broad social nature the income parameter invariably has a definite role and bearing on the outcome. Since the end of World War II, and particularly since the discovery of oil in Alberta at Leduc in 1947, Alberta has prospered to Canada's third wealthiest province (48), and income and university student enrolments have grown with it (Ref. APPENDIX I).

Because, however, university enrolment drop-offs recorded in 1970/71 and 1971/72 came not only at the end of the so called "baby boom" surge of students through the university system but also during the time of a very serious Canadian economic recession, provincial income was considered doubly important for analysis. As TABLES II-3 and II-6 clearly show, university freshman enrolment can exceed current matriculants, yet, only a portion of current fully qualified matriculants are attracted directly to university. The choice of attending university or not is thus very much influenced by the economic climate of the time (62), (i.e. income, savings, job opportunities, etc., Ref. APPENDIX I) in addition to other important potential benefits and personal individual decisions. To demonstrate the effects of provincial income on University of Alberta enrolment the following analyses were performed.

First, TABLE II-10 was prepared showing the U. of A. urban and rural enrolment of the past decade by provincial census divisions. Bearing in mind previous remarks on substantial enrolment increases for the Universities of Calgary and Lethbridge in Southern Alberta, the following observations based upon TABLE II-10 data can be made for the U. of A. for continued reference.

TABLE II-10

THE UNIVERSITY OF ALBERTA URBAN AND RURAL ALBERTAN STUDENT ENROLMENT BY CENSUS DIVISIONS *

ALBERTA CENSUS DIVISION	1956/57			1961/62			1964/65			1965/66			1966/67		
	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL	URBAN	RURAL	TOTAL
1	41	20	61	83	14	97	97	39	136	85	36	121	82	25	107
2	89	118	207	226	100	326	259	155	414	219	152	371	241	125	366
3	8	42	50	71	9	80	61	35	96	54	46	100	57	39	96
4	0	21	21	10	23	33	15	20	35	20	23	43	25	15	40
5	0	37	37	21	37	58	22	41	63	32	40	72	40	32	72
6	372	3	375	419	185	604	569	156	725	607	149	756	677	144	821
7	0	101	101	54	109	163	59	118	177	74	135	209	67	152	219
8	70	111	181	247	49	296	207	157	364	220	156	376	243	158	401
9	0	42	42	5	61	66	53	27	80	45	33	78	48	26	74
10	67	192	259	106	320	426	148	346	494	199	355	554	213	416	629
11	1503	589	2092	3223	488	3711	4470	446	4916	5152	452	5604	5877	486	6363
12	0	98	98	21	143	164	29	167	196	45	178	223	60	179	239
13	0	90	90	16	135	151	63	127	190	66	134	200	91	139	230
14	0	33	33	38	19	57	37	38	75	42	35	77	42	44	86
15	31	134	165	50	218	268	98	220	318	128	227	355	142	219	361

	1967/68			1968/69			1969/70			1970/71			1971/72		
1	75	25	100	70	43	113	95	31	126	111	31	142	108	28	136
2	254	110	364	228	127	355	246	122	368	214	118	332	230	90	320
3	64	39	103	51	42	93	60	42	102	69	33	102	67	28	95
4	23	19	42	24	15	39	21	18	39	17	19	36	13	16	29
5	36	36	72	35	34	69	31	20	51	36	25	61	35	21	56
6	672	133	805	706	154	860	714	172	886	717	165	882	759	132	891
7	92	142	234	82	187	269	91	155	246	87	160	247	77	121	198
8	269	149	418	272	239	511	339	202	541	302	193	495	298	190	488
9	53	29	82	53	26	79	44	26	70	42	26	68	42	23	65
10	238	423	661	233	534	767	241	487	728	265	553	818	274	485	732
11	7129	537	7666	8406	717	9123	10300	751	11051	11057	778	11835	11302	659	11961
12	100	188	288	91	246	337	122	248	370	117	247	364	123	211	334
13	108	145	253	100	170	270	116	209	325	151	190	341	137	181	318
14	55	49	104	77	60	137	83	61	144	85	63	148	82	58	140
15	160	230	390	138	286	424	138	308	446	141	328	469	140	282	422

* Source: Refs. 35, 36, 37.

The University of Alberta (U. of A.) enrolment from Southern Alberta (census divisions 1 through 6) has been relatively flat or stable from 1969 to 1971/1972, although there has been a 12% shift from rural to urban from 1968/1969 to 1971/1972. Absolute U. of A. student increases have not been obtained from the south. On the other hand Central and Northern Alberta (census divisions 7 through to 15), which traditionally have been U. of A.'s strongest drawing area, have shown absolute student decreases in 1970/1971 and 1971/1972, contributing to the sagging university enrolment experience of late. Of these decreases, rural enrolment declines were larger than urban in the case of each census division mentioned. Fortunately urban enrolment didn't all decrease absolutely even though percentage gains, or earlier university projected enrolments, didn't substantially materialize. Census division 11 (Edmonton, etc., Ref. FIGURE 2.2) for example, increased from 11,057 to 11,302 students from 1970/71 to 1971/72 actually offsetting the rural decline in the division. Other minor urban increases are also evident upon close examination of TABLE II-10. The Central and Northern Alberta rural enrolment declines for The University of Alberta, however, are of some substantial consequence to the university and set the scene for examination of actual income data.

TABLES II-11 and II-12 were next prepared showing past trends in provincial income (3). Family income was selected as the best available type of income measure as so very many students receive help from home particularly in the freshman year. From the tables, particularly regarding U. of A.'s traditional area census divisions 7 through 15 (Ref. FIGURE 2.2), the 1970 economic recession shows income was adversely affected in census divisions 7, 10 and 12 in 1969 and in

TABLE II-11

ALBERTA AVERAGE INCOME REPORTED FROM ALL INCOME TAX RETURNS BY CENSUS DIVISION, REPORTED AS PERCENT OF PROVINCIAL YEARLY AVERAGE

CENSUS DIVISION	1961	1966	1967	1968	1969	1970
1	91.5%	94.6%	94.8%	94.5%	87.3%	88.6%
2	85.0	92.6	96.9	94.8	90.5	89.7
3	82.2	86.2	87.5	82.4	78.4	81.9
4	78.0	99.3	92.2	91.1	76.2	74.2
5	75.1	101.1	107.8	91.0	77.3	74.5
6	110.2	111.7	110.6	110.7	111.2	110.3
7	81.5	86.0	84.6	85.3	75.4	73.1
8	90.8	89.6	86.3	85.0	85.1	83.5
9	92.6	98.1	104.3	100.9	104.8	103.7
10	79.7	76.2	75.9	77.3	71.5	71.7
11	105.1	104.5	105.1	106.1	108.1	109.1
12	85.6	73.7	76.3	74.2	70.7	74.5
13	76.0	72.2	64.9	65.7	68.3	66.7
14	98.9	96.3	94.5	96.8	100.1	99.6
15	79.9	75.5	74.1	75.4	75.6	75.7
ALBERTA AVERAGE INCOME	$3214	$4259	$4515	$4773	$5063	$5312

* Source: Ref. 3.

TABLE II-12

AVERAGE INCOME REPORTED FROM

ALL INCOME TAX RETURNS FOR SELECTED AREAS ALBERTA*

AREA DESCRIPTION	CENSUS DIVISION 8 WITH RED DEER REMOVED	CENSUS DIVISION 11 WITH EDMONTON REMOVED
1966		
No. of Returns	17599	15647
Total Income ($1,000)	61807	60381
Average Income ($1)	3512	3859
Division Average Income as % of Alberta	82.5	90.6
1967		
No. of Returns	17752	15327
Total Income ($1,000)	62931	61933
Average Income ($1)	3545	4041
Division Average Income As % of Alberta	78.5	89.5
1968		
No. of Returns	19122	18273
Total Income ($1,000)	70594	72552
Average Income ($1)	3692	3970
Division Average Income as % of Alberta	77.4	83.2
1969		
No. of Returns	18704	20319
Total Income ($1,000)	72992	91510
Average Income ($1)	3902	4504
Division Average Income as % of Alberta	77.1	89.0
1970		
No. of Returns	21720	21275
Total Income ($1,000)	86409	101511
Average Income ($1)	3978	4771
Division Average Income as % of Alberta	74.9	89.8

* Source: Ref. 3.

census divisions 8, 9, 13 and 14 in 1970. These divisions are all of immense importance to The University of Alberta, of course, and an examination of TABLE II-10 indicates that income and enrolment declines per census division bear a marked similarity.

A few examples will serve better to demonstrate this point. In census division 7 from 1968/1969 to 1969/1970 urban enrolment increased substantially while rural fell substantially as did income. 1970 witnessed the worst income for the division at the height of the recession and in 1971/1972 all enrolment again dropped off sharply. As economic recovery in Canada and Alberta did not start until late 1971, poor university enrolment from the division could be expected in 1971/1972. The University of Alberta enrolment situation for census division 10 is quite similar, whereas enrolment declines in division 12 lagged the sagging economy by at least one year.

Rural enrolment from census division 8 fell sharply in 1969/1970 and 1970/1971 as did rural income (Ref. TABLE II-12). Rural enrolment in census division 13 fell in 1970/1971 as did income opposite to urban student increases. Rural enrolment declines in census division 14 lagged the economic low by one year. The general situation of some census division enrolments lagging income declines by a year or more appears to be a reasonable thing to happen. TABLE II-13 featuring provincial unemployment rates (46) indicates that from the unemployment rate point of view the six month period ending April 1971 was recorded as the "worst" (in at least one decade) employment period in the Alberta economy, supporting the previous statement. The fact of the matter is unemployment rates are not reflected in income used in any direct

TABLE II-13

PROVINCE OF ALBERTA

LABOUR FORCE UNEMPLOYMENT RATES*

MONTH/YEAR	1969	1970	1971	1972
JANUARY	3.6%	4.2%	6.5%	5.1%
FEBRUARY	3.4	4.6	6.0	5.0
MARCH	3.6	5.2	6.6	4.9
APRIL	2.9	5.2	5.9	5.2
MAY	2.2	3.9	4.6	4.2
JUNE	2.4	4.2	3.7	4.1
JULY	2.5	4.1	4.0	3.9
AUGUST	2.2	3.2	3.3	3.6
SEPTEMBER	1.9	2.9	3.1	3.3
OCTOBER	2.2	3.5	3.7	3.7
NOVEMBER	3.2	5.3	4.2	5.1
DECEMBER	2.8	5.7	4.5	5.3

* Source: Ref. 46.

manner and thus both relatively independent points of view must be viewed for economic clarity.

Income analysis alone is not entirely effective in demonstrating what happened, with respect to the situation at hand, in census division 11 which includes Edmonton (Ref. FIGURE 2.2). 1971 Census of Canada income data which is not available at this time may correct this problem when available. Thus an unemployment rates supplement (14) was again consulted showing Edmonton and/or census divisions 8 and 11 with high average unemployment rates throughout 1971 (Ref. APPENDIX I), which in addition to monthly figures on unemployment rates, shows that urban unemployment was serious and in part explains the relatively stagnant university enrolment from census division 11, as opposed to university anticipated increases. In essence neither exceptional family income, jobs nor general economic promise to families, individuals or university students were present in the economy at the time. General business confidence was at, and persisted at, the lowest ebb in years.

With regard to census division 15, the Peace River Block, TABLE II-11 shows that general family income has been off the general provincial pace for years. This situation plus significant unemployment (Ref. APPENDIX I) has no doubt had a similar serious effect on University of Alberta enrolment.

Bearing in mind The University of Alberta's declining enrolments have been isolated as significantly rural in nature a search was made for even more conclusive evidence that income is the problem. And thus, finally, agricultural income data was secured to bring home the full impact of the rural ramifications of the severe Canadian economic recession of 1969-1970-1971.

APPENDIX I, TABLES IV and V (Canadian Wheat Board Exhibits VI), Statement of Advance Payments to Producers under the Prairie Grain Advance Payments Act (5, 6), as at July 31, 1970 and 1971, clearly show that cash advances to prairie farmers were at an all time high of $272,777,516 indicating the seriousness of the family farm income situation at the brunt of the recession. An estimated 30% of the amounts shown belong to the Province of Alberta farmers. The outstanding balance of $137,304,568 is another key figure to a chronic income situation at July 31, 1970, as is the comparable figure of $22,371,283 one year later. By 1971 neither net nor gross Alberta farm income (45) had yet made it back to levels of 1968 (Ref. APPENDIX I, TABLE VI). The latter appended figures refer, of course, to farmer income from all sources whereas the former figures deal with prairie grain. The two sets of figures are very much related however as in general a severe grain income problem complicates timely diversification to livestock and other crops to bolster failing farm income from grain. In short, Alberta farm families have recently lived through some very hard times (67) (Ref. APPENDIX I) and in retrospect it is amazing that rural University of Alberta enrolment held up as well as it did.

At this point this research project will recognize several important aspects of income analysis for which there was insufficient time to develop. First the process of urbanization is known to be well advanced in Alberta leaving in its wake many destitute hamlets and/or economically declining towns in rural areas. The impact of the 1970 economic recession on this process and in turn on university enrolments was not measured but no doubt is a factor. The above situation in turn leads to another problem beyond the scope of this project: the

maintenance of minimal educational standards in declining rural areas, an essentially economic problem. Lastly, Seastone (42) reports that in 1967, for example, 40% of the taxpaying Alberta public in the $3,000 per year or less income category earned only 13.7% of the taxable income. This immediately alludes to the less than good educational opportunities the children of these individuals may have, rural and urban. Seastone's (42) discussion of these kinds of points above should be referred to.

In summary, as Alberta's economy, and farming in particular, again begins to grow, and with decreased unemployment, urban and rural university enrolment will no doubt begin to grow. However, as general Canadian business confidence has been slow returning from the 1970 recession, a similar pattern in university student confidence would not be unreasonable. Crop failures after 1970 continued to affect Northern Alberta (63) and thus provincial economic recovery can have varied regional rates.

This income analysis which relates to the recent phenomena of sagging university enrolments in an otherwise growing and wealthy province, explains what happened in part and yields insight for student population forecasting to follow.

2.2.2. City of Edmonton

2.2.2.(a) General

The previous analysis of the provincial university student enrolments situation has alluded many times to the great importance of census division 11 (Edmonton area, Ref. FIGURE 2.2) to The University of Alberta. The City of Edmonton and Metropolitan area has been and will continue to be the major source of University of Alberta enrolment. Thus "the city" on a micro level as opposed to "the province" on a macro

level requires an analysis of its own. The continual processes of city demographic and land use changes, not to mention external forces, social, economical, and otherwise, will have a definite impact upon the welfare of city educational institutions including the U. of A.

Unlike the broad, yet no less meaningful, style of provincial analysis used, available resources permit a different, even more searching, kind of analysis of the City of Edmonton to be performed. The classical use of transportation studies (1, 2, 34) (data) performed by the university over the years, facilitates the examination of the more enduring relationship of people and their transportation needs tied to city residential land use. The studies (1, 2, 34) which served more immediate important purposes at the time are examined in a new context to serve again.

In essence, from past transportation studies, where resident and non-resident Edmontonian students lived is known, and thus facilitates close comparison to known city population and land use trends to ascertain the relationship. The ease of converting data from the METS zones (22) used in the past to the Census of Canada (16, 17, 47) city population tracts (which "are designed with a view to providing basic census statistics for areas which are homogeneous with respect to economic status and living conditions") facilitates the use of social and economic dimensions in the analyses. FIGURES 2.5 and 2.6 show the Federal Census Tract and Metropolitan Edmonton Transportation Study (METS) zone definitions.

The City of Edmonton analyses for university population forecasting which follows, therefore, examines University of Alberta

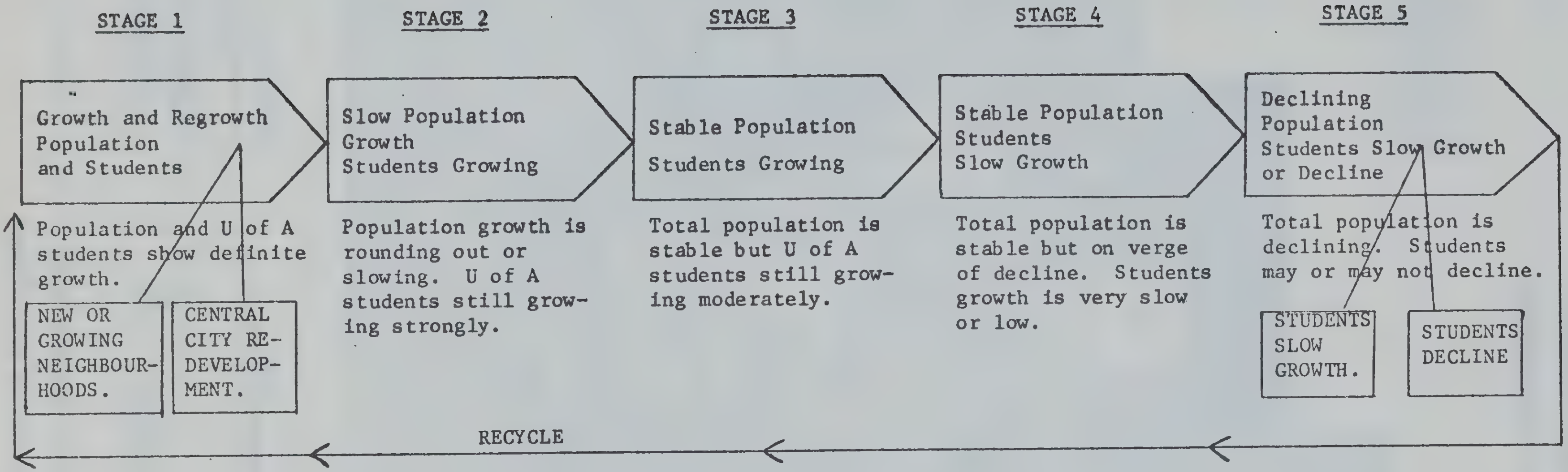
students, city population characteristics, age of subdivision and income all, in effect, at the neighbourhood level of detail.

2.2.2.(b) Population

From available census information (16, 17, 19, 47) semi-logarithmic plots of resident Edmonton, University of Alberta students (36) and related population per city census tract, were made covering the period 1956 to 1971. Again, as for the provincial analysis, the object was to discover the relationship of students to various logical age groupings of the recorded city population per census tract. In this regard the 15 to 24 age group was found to be the most relevant (Ref. Sample Semi-Log Plots APPENDIX I). Note that the 1966 City of Edmonton census tract definitions (Ref. FIGURE 2.5) were used, and that the number of tract arrangements used were considered adequate for this analysis as summarized on TABLE II-14.

Prior to actual analysis work, during the study conceptualization stage, it had been suspected that the semi-logarithmic plots for the city would "type out" into possibly 8 or 10 distinctly identifiable demographic patterns or groupings. Thus upon completion of all plots the researchers gave due examination of results, and quite unexpectedly discovered the rudiments of a five pattern demographic and residential land use cycle respecting University of Alberta students. This finding is described and summarized for the City of Edmonton on FIGURES 2.3 and 2.4. Sample semi-logarithmic plots of each stage of the cycle are appended (Ref. APPENDIX I), and can be further described as follows.

Stage one graphs of growth and regrowth of population and students in new and redeveloping city neighbourhoods is the easiest


STAGE 1
STAGE 2
STAGE 3
STAGE 4
STAGE 5
Growth and Regrowth Population and Students
Slow Population Growth Students Growing
Stable Population Students Growing
Stable Population Students Slow Growth
Declining Population Students Slow Growth or Decline
Population and U of A students show definite growth.
NEW OR GROWING NEIGHBOURHOODS.
CENTRAL CITY REDEVELOPMENT.
Population growth is rounding out or slowing. U of A students still growing strongly.
Total population is stable but U of A students still growing moderately.
Total population is stable but on verge of decline. Students growth is very slow or low.
Total population is declining. Students may or may not decline.
STUDENTS SLOW GROWTH.
STUDENTS DECLINE
RECYCLE

NEIGHBOURHOODS BEHAVING AS DESCRIBED ABOVE

1966 CENSUS TRACT NUMBERS

STAGE 1		STAGE 2	STAGE 3	STAGE 4	STAGE 5
GROWTH	REGROWTH				
33	4	1,35,55	5,6,7	20	9,10
45	13	21,40	3,8,36,37	22	11
43,47	14		25,26,27,48	28	12,16
49,50	15,39		31,32,34,44	17,38	
51	18,19		41,42	29,30	
2,52,53,54	23				
56,57,58,59	24				
60,61					
61,62					
Sherwood Park					
St. Albert					

FIGURE 2.3. POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE CITY OF EDMONTON 1970/1971

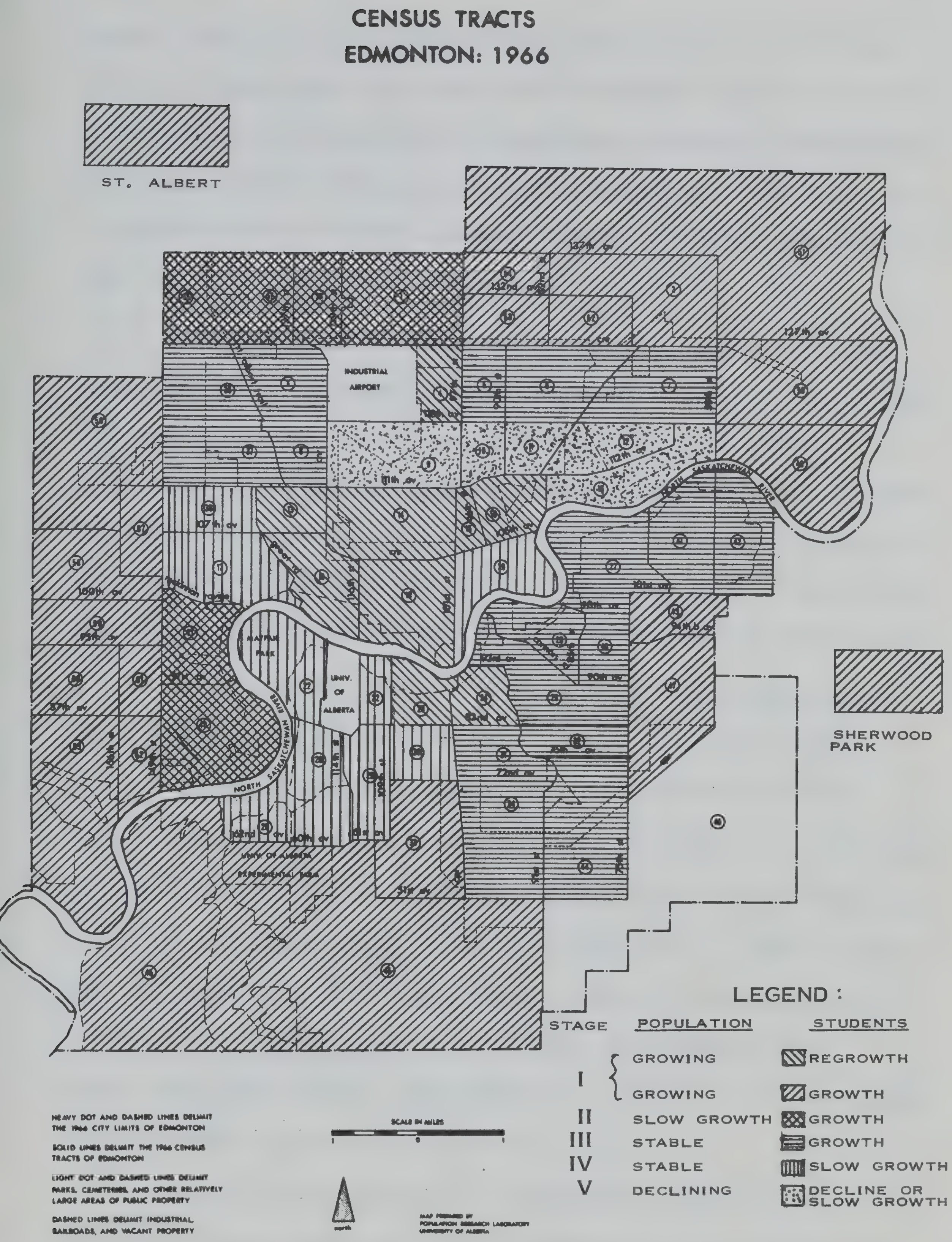


FIGURE 2.4. POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE 1970/1971

[illegible]

stage to identify, with definite strong upward growth trends evident. Regrowth of population and students follows closely, central city areas given over to walk-up and high-rise apartment developments, the proximity of which to The University of Alberta having had a definite bearing on resident Edmonton student regrowth patterns. Suburban universities might not have such a regrowth pattern.

Stage one growth and regrowth gradually decreases over time coming into stage two which is characterized by a definite slowing down in population growth, followed by stable population or stage 3. In stage 2 and 3 although total population growth is slowing down and then flattening respectively, student growth ranges from strong to moderate. This apparent phenomenon is, of course, due to the aging of children up into the 15 to 24 age group relevant to university student generation.

Stage 4 of the cycle is characterized by stable population, often apparently on the verge of major decline, and slowly growing university student numbers, also not far from a decline potential.

Of particular interest regarding stage 4 is that where city land use zoning allows walk-up or high-rise redevelopment housing to proceed before the population-student generation cycle runs its course, stage 5 may be skipped, thus re-entering stage 1, regrowth, directly. Most census tracts analyzed and found in stage 4 are candidate for stage 5, but some through redevelopment (e.g. 29 and 30) may go directly back to student and population regrowth.

Stage 5 is characterized by all population generally declining with the options of resident students decreasing or increasing. Two aspects about this stage as it relates to the overall population student

cycle should be mentioned. Firstly and secondly there are high and low socio-economic neighbourhoods involved now or potentially. And the implied redevelopment phase next shown in the cycle may or may not enter either type of neighbourhood for years to come, depending upon a number of obvious factors. Thus this research should not be misinterpreted to mean, for example, that Windsor Park (Ref. FIGURE 3.6) is about to be redeveloped.

In stage 5 the obvious thing to happen would be for resident Edmonton students to decline. Unfortunately the peculiarities of the city are such that no examples of the normal situation were found at this time. Instead, increasing resident Edmonton students in decreasing population zones was encountered, a phenomenon which appears to be due to an abundance of old rooming houses, and otherwise a good economic and sociologically interesting environment, in several older central city areas of Edmonton.

Having thus outlined the neighbourhood population and university student neighbourhood generation cycle, there remained but to summarize, from and on the basis of the graphs by stages (1 to 5), the current student generation factors for use in the subsequent population forecast, shown on TABLE II-14.

2.2.2.(c) Age of Subdivision

This phase of the neighbourhood resident Edmonton student generation analysis dealt with the essential question of how long a time is it from the commencement of a new or redeveloped neighbourhood until generation of substantial numbers of University of Alberta students? Substantial numbers of students was assumed to mean approximately 18 or

TABLE II-14

EDMONTON STUDENT NEIGHBOURHOOD GENERATION POPULATION FACTORS

(UNIVERSITY SOCIAL INDICES)

Cycle Stage	Analyses Zones: 1966 Census Tract Number(s)	1966/67			1971/72			Remarks 1981/1982 Anticipated Index
		Age 15-24 Population	Resident Edmonton U. of A. Students	University Social Index	Age 15-24 Population	Resident Edmonton U. of A. Students	University Social Index	
I. REGROWTH Population and Students.	4	771	41	.05318	1360	97	.07132	Growth
	13 14	889 2595	95 138		1075 3750	141 298		
	15,39	1473	53	.03598	1975	98	.04962	Growth
	18,19 23 24	4278 759 1335	335 196 168	.09456	5600 1275 1660	703 438 330	.14296	Growth
I. GROWTH Population and Students.	33 45	1590 1215	202 293	.17647	1950 3600	294 1058	.24360	Growth
	43,47	1969	194	.09853	2630	313	.11901	Growth
	49,50 2,52,53,54	1545 3353	61 159	.04492 .04492	2200 4350	117 276	.06000 .06000	Growth Growth
	56,57,58,59	3112	106	.03406	4640	291	.06272	Growth
	60,61	1536	111	.07227	2430	256	.10535	Growth
	62,63	990	92	.09293	1500	220	.14667	Growth
	Sherwood Park (Estimate)	924	48	.05195	2850	153	.05368	Growth

TABLE II-14 - (Continued)

Cycle Stage	Analyses Zones: 1966 Census Tract Number(s)	1966/67			1971/72			Remarks 1981/1982 Anticipated Index
		Age 15-24 Population	Resident Edmonton U. of A. Students	University Social Index	Age 15-24 Population	Resident Edmonton U. of A. Students	University Social Index	
	St. Albert	1022	65	.06360	1570	170	.10828	Growth
	51	336	5	.01488	2185	86	.03936	Growth
II. SLOW POPULATION GROWTH GROWING STUDENTS	1,35,55	3648	174	.04742	4550	324	.07121	Growth
	21,40	1895	370	.19525	2350	587	.24980	Growth
III. STABLE POPULATION STUDENT GROWTH	31,32,34,44	3659	281	.07680	4260	463	.10869	Growth
	25,26,27,48	4663	451	.09672	5350	676	.12636	Growth
	41,42	1568	188	.11990	2160	317	.14676	Growth
	5,6,7	3639	144	.03957	4270	247	.05785	Growth
	3,8,36,37	4181	370	.08850	4700	451	.09596	Growth
IV. STABLE POPULATION SLOW STUDENT GROWTH	22 28	1568 1036	529 292	.31528	1568 1180	564 353	.33370	Decline
	29,30	2425	522	.2153	2900	659	.22720	Regrowth
	20	995	46	.04623	1160	53	.04569	Decline
	17,38	2253	360	.15978	2550	435	.17059	Decline
V. DECLINING POPULATION	9,10	2212	120	.05425	2215	159	.07178	Decline
	11	843	33	.03915	920	45	.04891	Decline
	12,16	1669	170	.10186	1550	183	.11807	Regrowth

more students per METS zone. To answer the question the following analysis was performed.

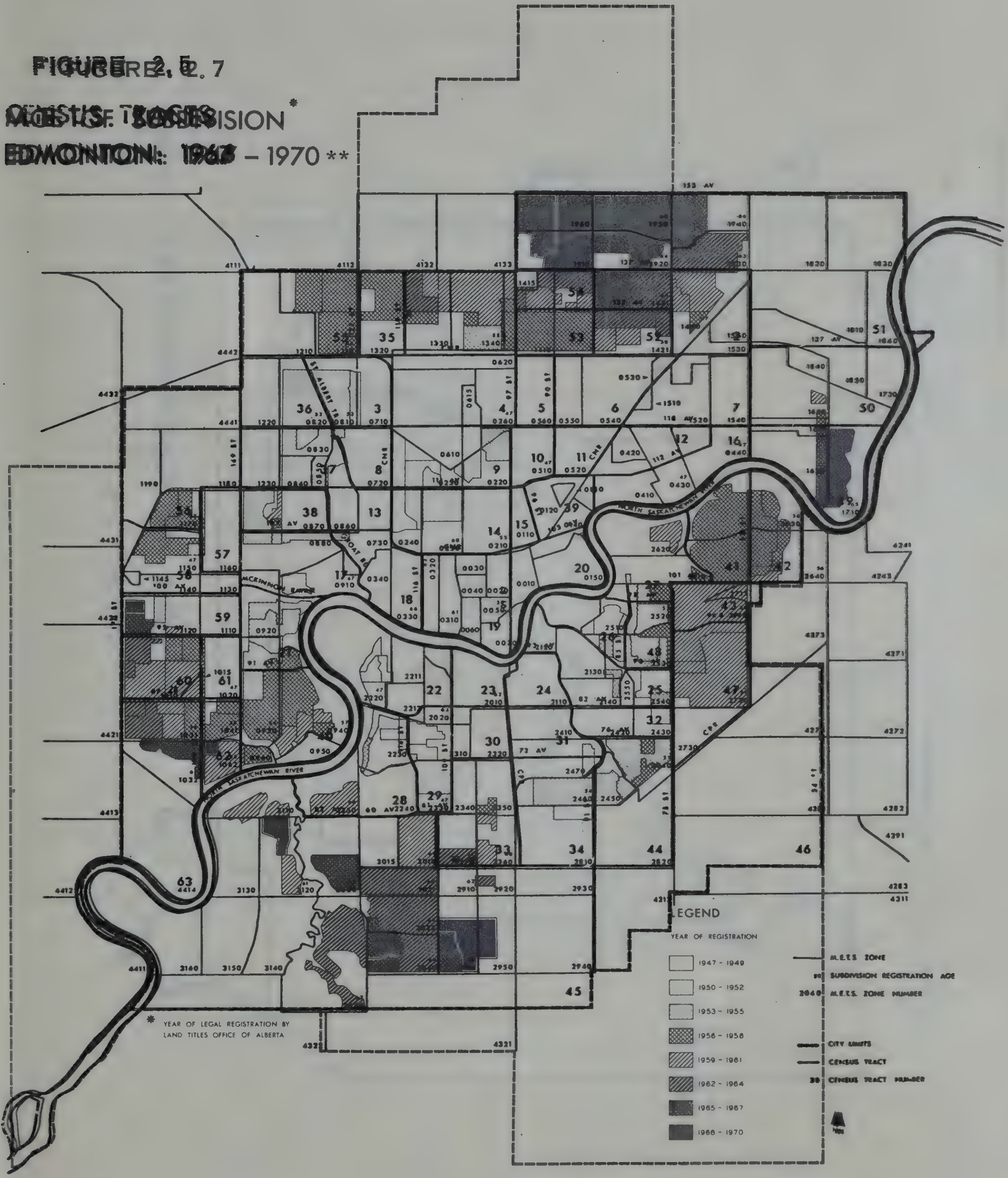
First, from city records of age of registration of subdivision (61), the substantial starting time in years of relevant neighbourhoods developed since 1947 was recorded on a METS zone land accounting basis. FIGURES 2.7 and 2.6 show the ages of the relevant subdivisions and the corresponding METS zones, respectively, while FIGURE 2.5 shows the 1966 Census Tracts in relation to them. Where an insignificant start was made on the residential land within a METS zone the substantial age was taken as the point when 20% or more of the residential land was part of a registered subdivision and therefore came into use. St. Albert and Sherwood Park, which are shown on FIGURE 2.8 in relation to Edmonton, were given ages of subdivisions based on the first major new subdivisions of 1957, disregarding the many new subdivisions added since.

Next, resident Edmonton students recorded per METS zone (34) were plotted against the appropriate city population (53) to determine the time in years when substantial resident Edmonton students were generated from a zone. The Student Lag Factors [defined as the delay in years between the start of a new neighbourhood and significant university student generation (i.e. 18 or more per METS zone)] were then measured from the curves as the difference in years from substantial start of subdivision per METS zone, until generation of substantial numbers of resident Edmonton University of Alberta students. The reason for plotting population rather than simply using age of subdivision was to yield better insight into student and related population growth patterns for more accurate Student Lag Factor estimations. Sample arithmetic plots are appended (Ref. APPENDIX I), showing the salient features of the method.

FIGURE 2.7

AGE OF SUBDIVISION*

EDMONTON: 1947 – 1970 **



* YEAR OF LEGAL REGISTRATION BY LAND TITLES OFFICE OF ALBERTA

** Source: Ref. 61.

FIGURE 2.6

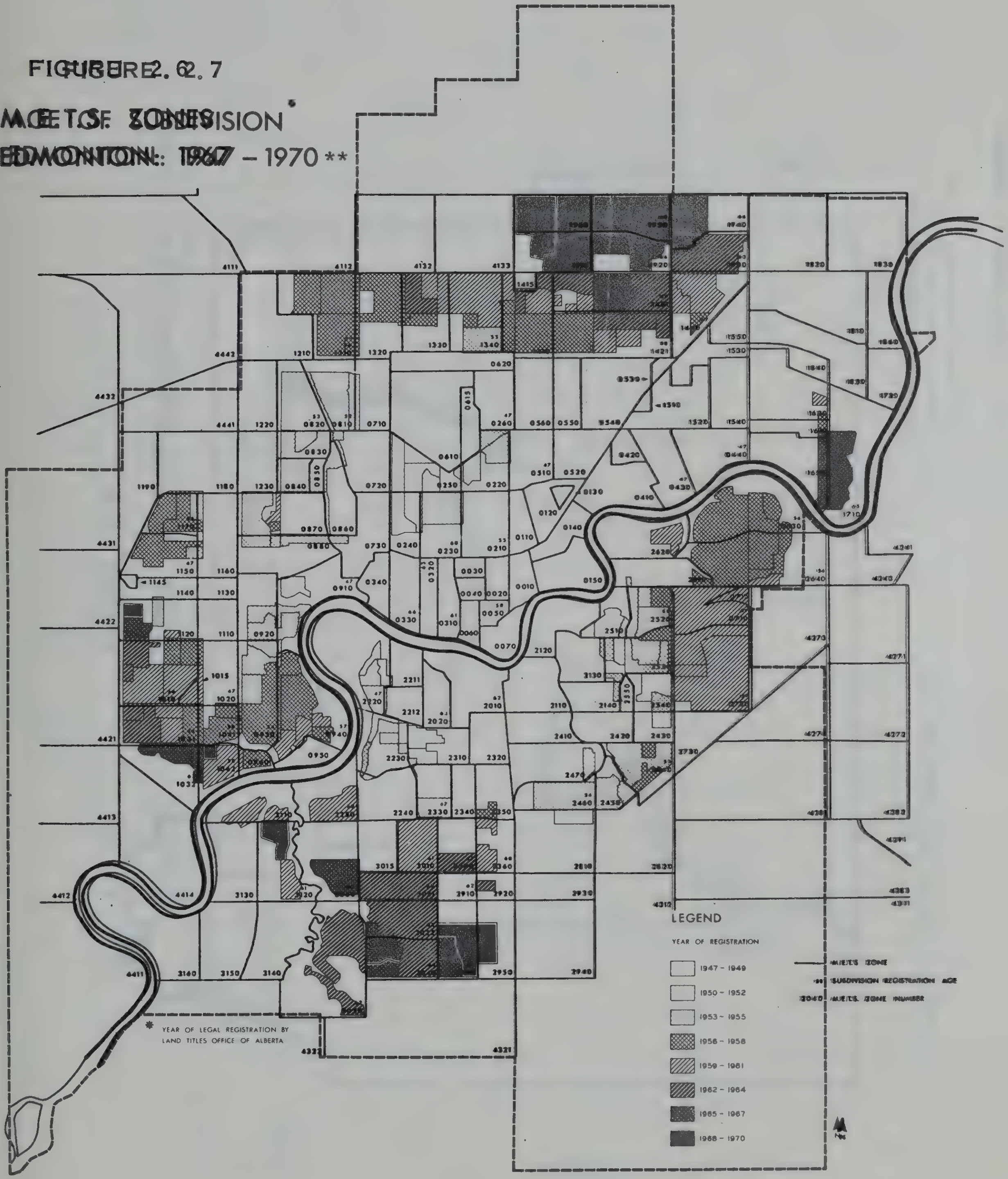
AGE OF SUBDIVISION

EDMONTON: 1947 – 1970 **

FIGURE 2.7

M.E.T.S. ZONES

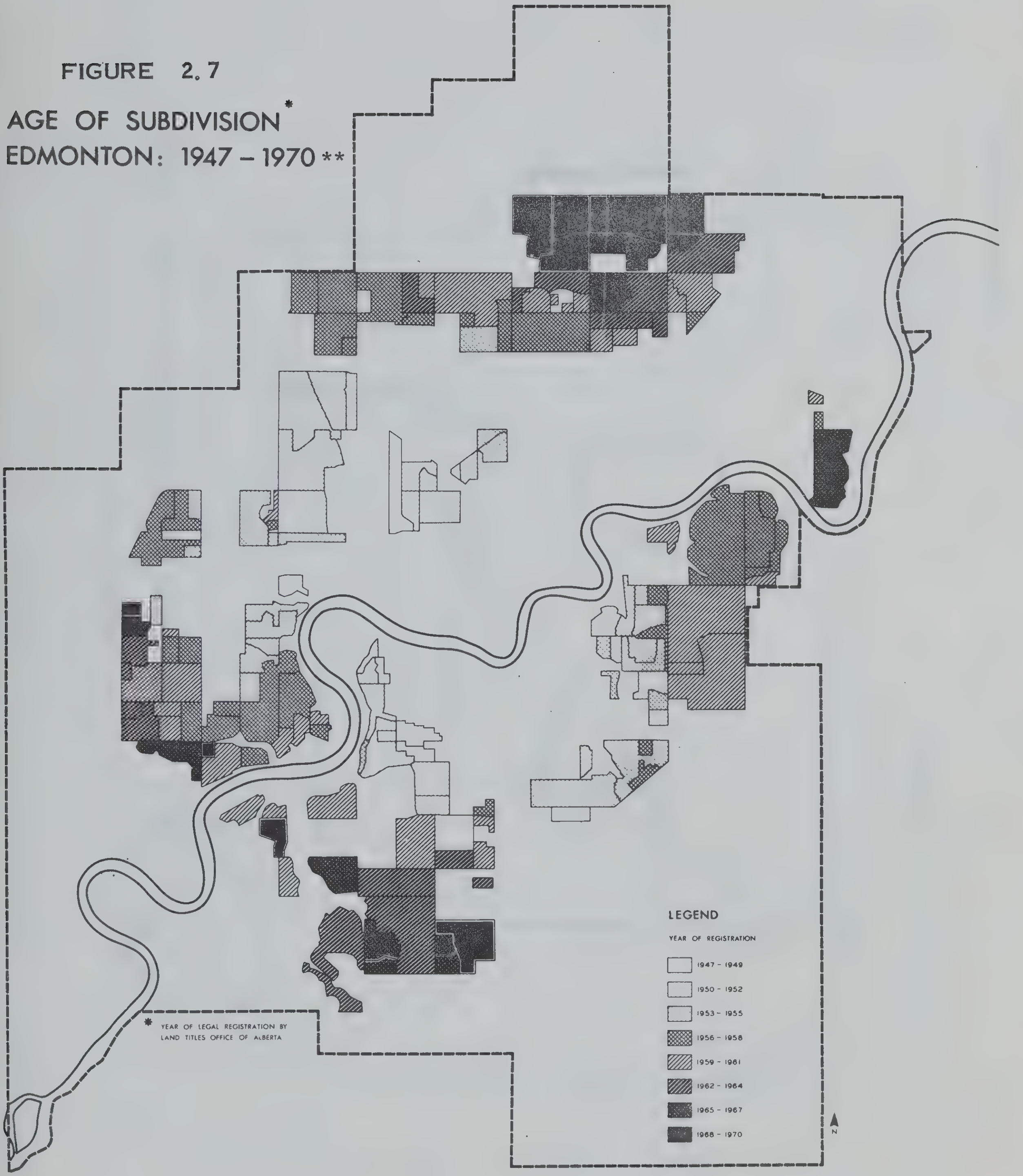
EDMONTON: 1967



** Source: Ref. 61.

FIGURE 2.7

AGE OF SUBDIVISION*
EDMONTON: 1947 – 1970 **

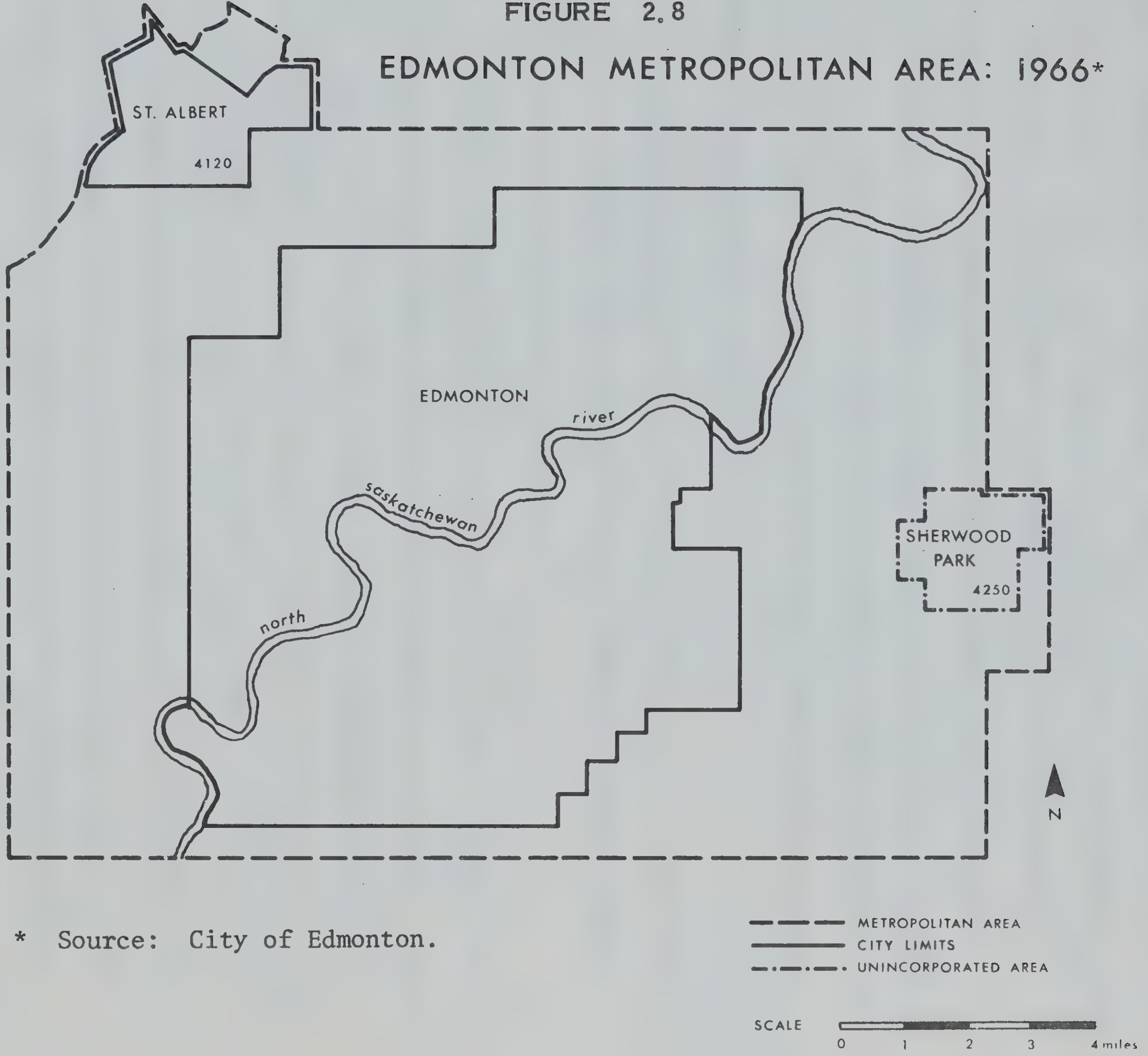


* YEAR OF LEGAL REGISTRATION BY LAND TITLES OFFICE OF ALBERTA

** Source: Ref. 61.

FIGURE 2.8

EDMONTON METROPOLITAN AREA: 1966*



* Source: City of Edmonton.

The method for the determination of student Lag Factors in the zones of city residential redevelopment was similar except for determination of the time of substantial start of redevelopment in the METS zones. In this case the substantial start was ascertained from city records of age of all walk-up and high-rise apartment developments (58) and was taken to be the time in years when at least 250 apartment dwelling units had been developed within the METS zone in question. Also, as substantial numbers of students were there before redevelopment, the time in years of major new resident Edmonton student generation was taken as the point at which their growth took a sharp increase attributable to the new living opportunities.

The last step in the analysis was to summarize all student Lag Factors by years and METS zones as shown on FIGURE 2.9 and to examine same for similarities or city patterns.

In this regard, a very simple pattern was found to yield the best explanation via marked similarities in student Lag Factors. TABLE II-15 summarizes these study findings on a city geographic sector basis, similar to city income patterns to follow, with the exception of the redevelopment zone. An explanation is in order.

Student Lag Factors in the redevelopment zone for METS zones 0050 (high-rise) and 0210 (walk-ups) were 6 and 7 years prior to the general acceptance of apartment living by resident Edmonton students. As high-rise and walk-up developments spread west on the north and south sides of Edmonton (58), student Lag Factors diminished to, and remain at one year, since marked general acceptance of the apartment way of living by resident Edmonton students in 1966 and 1967.

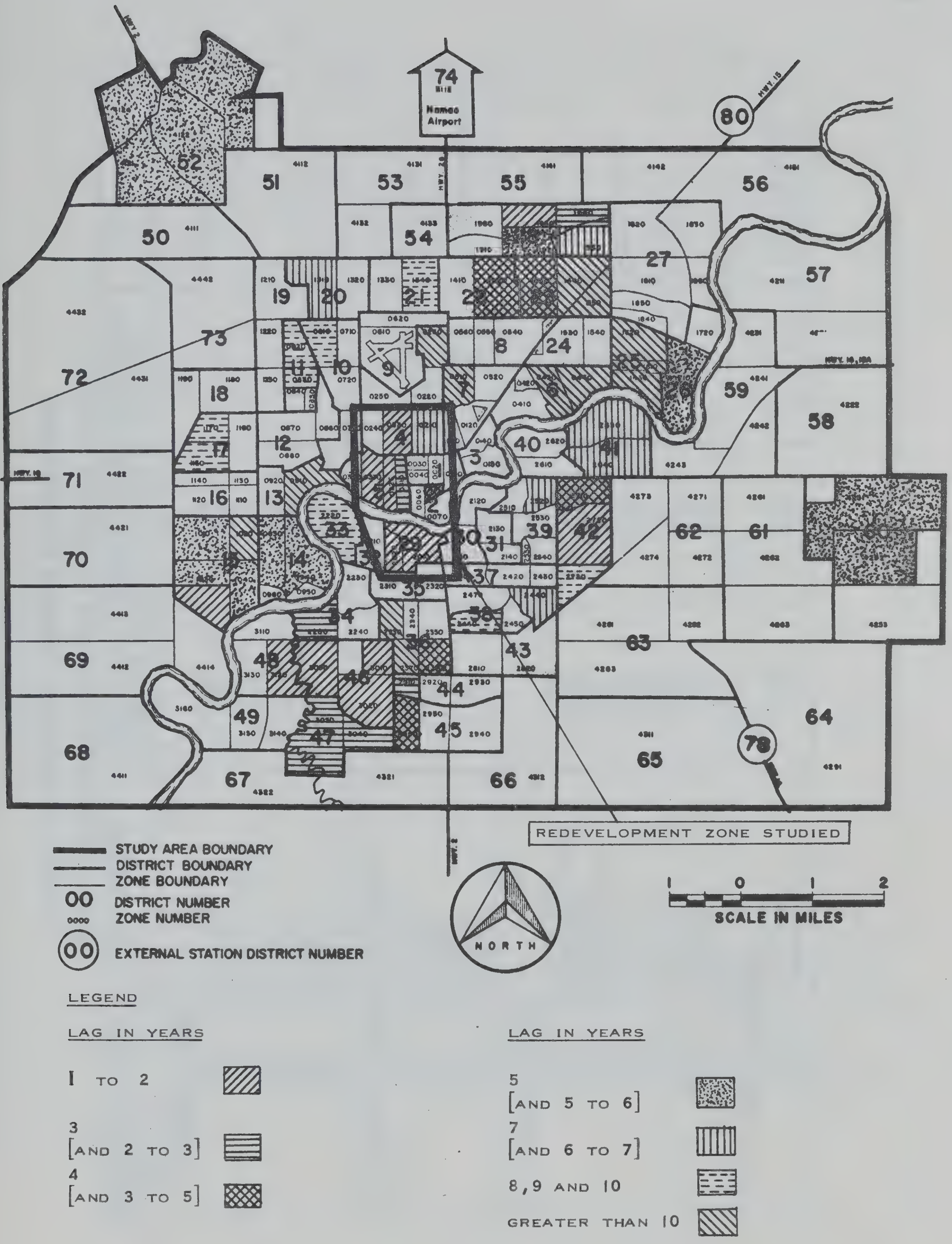


FIGURE 2.9. SELECTED METROPOLITAN EDMONTON NEIGHBOURHOODS - UNIVERSITY STUDENT GENERATION LAG FACTORS (Years)

TABLE II-15

SELECTED METROPOLITAN EDMONTON NEIGHBOURHOODS - UNIVERSITY STUDENT GENERATION LAG FACTORS (YEARS)

GEOGRAPHIC AREA	METS ZONE	NEIGHBOURHOOD	SUBDIVISION REGISTRATION AGE	SUBSTANTIAL LAND USE START, AGE	U OF A STUDENT LAG YEARS	COMMENT
I. REDEVELOPMENT ZONE						
	0050	Rossdale	1958	1961	6	Redevelopment Lags
	0210	Churchill	1955	1959	7	"
	0230	Queen Mary Park	1960	65	1	"
	0310	Oliver	1961	1963	3	"
	0320	Oliver	1963	1966	1	
	0330	Oliver	1966	1966	1	"
	2010	Strathcona	1962	1965	1	"
	2020	Garneau	1964	1965	1	"
II. NORTH SIDE - OLDER NEIGHBOURHOODS						
	0260	Northcote	1947	1947	16	
	0430	Bellevue	<1947	1947	10-12	Estimate only
	0440	Highlands	<1947	1947	10-12	"
	0510	Norwood	<1947	<1947	15+	"
	0810	Sherbrook	1952	1953	10	New Style Subdivision
	0820	Dovercourt	1953	1954	9	
III. WEST END OF CITY						
	0910	Capital Hill	<1947	1947	12	Estimate Only
	0930	Crestwood-Parkview	1954	1955	5-6	
	0940	Valleyview	1957	1957	5-6	
	1010	Meadowlark Park	1956	1958	5-6	
	1020	Jasper Park	1947	1953	10-12	< MEANS "BEFORE"
	1031	Elmwood	1958	1958	6	
	1032	Rio-Terrace	1967	1967	1-2	
	1040	Lynnwood	1958	1958	5	
	1150	Britannia	1947	1953	10-12	
	1170	Mayfield	1955	1957	8	
VIII. SATELLITE COMMUNITIES						
	4120	St. Albert	1861	1957	5-6	Alberta's Oldest Town
	4250	Sherwood Park	1955	1957	5-6	Accurate Measure

TABLE II-15 - (Continued)

GEOGRAPHIC AREA	METS ZONE	NEIGHBOURHOOD	SUBDIVISION REGISTRATION AGE	SUBSTANTIAL LAND USE START, AGE	U OF A STUDENT LAG YEARS	COMMENT
IV. NORTH AND NORTHEAST OF CITY						
	1310	Wellington-Athlone	1956	1956	7	
	1340	Rosslyn Etc.	1955	1955	8	
	1420	North Delton	1958	1958	4-5	Less Lag than expected
	1430	Balwin-Delwood	1961	1962	4-5	"
	1440	Belvedere	1947	1947	20	
	1710	Rundle Heights	1965	1965	5-6	
	1920	Londonderry	1966	1966	5	
	1930	Steele Heights	1963	1963	7	
	1940	Steele Heights	1966	1966	3	
	1950	Londonderry	1968	1968	2	
V. SOUTH SIDE - OLDER NEIGHBOURHOODS						
	2220	Windsor Park	1947	1950	7-10	Estimate Only
	2330	Park Allen	1947	1950	12	"
	2360	Allendale	1960	1960	4	
	2370	Pleasant View	1947	1947	15	2nd Growth 1962
VI. EAST END OF CITY						
	2440	Avonmore	1955	1955	6	
	2460	Hazeldean	1954	1954	8	
	2520	Mount Pleasant	1953	1953	6-7	
	2630	Hardisty	1956	1956	6-7	
	2640	Fulton Place	1956	1956	7	
	2710	Ottewell	1959	1959	3-4	
	2720	Ottewell Ect.	1959	1959	1-2	Unexpected Lag.
VII. SOUTH-WEST PART OF CITY						
	2250	Grandview Heights	1960	1960	2-3	
	2910	Duggan	1962	1962	2-3	
	2960	Duggan	1966	1966	3	
	3010	Lendrum Place	1961	1961	1-2	
	3020	Malmo Plains Etc.	1963	1963	1-2	
	3030	Lansdowne	1965	1965	2	
	3040	Greenfields	1964	1964	3	
	3050	Westbrook-Aspen Gardens	1962	1962	3	
	3120	Riverbend	1961	1968	1-2	Early Small Subdiv. Start

Student Lag Factors in older north and south side city neighbourhoods generally exceed 10 years.

Student Lag Factors in newer city peripheral neighbourhoods follow two simultaneous time patterns. Firstly, student Lag Factors in the west end, north, east, southwest, and satellite areas of the city generally average 5 to 6 years, 4 to 7 years, 6 to 7 years, 2 to 3 years, and 5 to 6 years respectively. Secondly, in some of the above areas in recent new subdivisions, such as Rio Terrace and Lansdowne, student Lag Factors have fallen markedly to 1 to 2 years due to families locating there with university age children. This latter pattern may be due to a somewhat general affluent buildup of increased housing needs, precipitating a methodical shift to higher socio-economic neighbourhoods, at the outset of an apparent period of rapid escalation of house mortgage interest rates. The timing and behavior of these neighbourhoods would tend to bear this out. Clearly, the whole pattern has socio-economic undertones which are not here explored as they are not considered part of this thesis.

The object of this portion of the research has been to identify student Lag Factor behavior of the various city areas which has now been done for later use in population forecasting.

2.2.2.(d) Income

Income is invariably a strong parameter and proves to be so in this analysis.

From the 1961 Federal Census, family income for Edmonton census tracts (16) was summarized as shown on FIGURE 2.10. Unfortunately the 1966 Federal Census did not include income and the 1971 census results

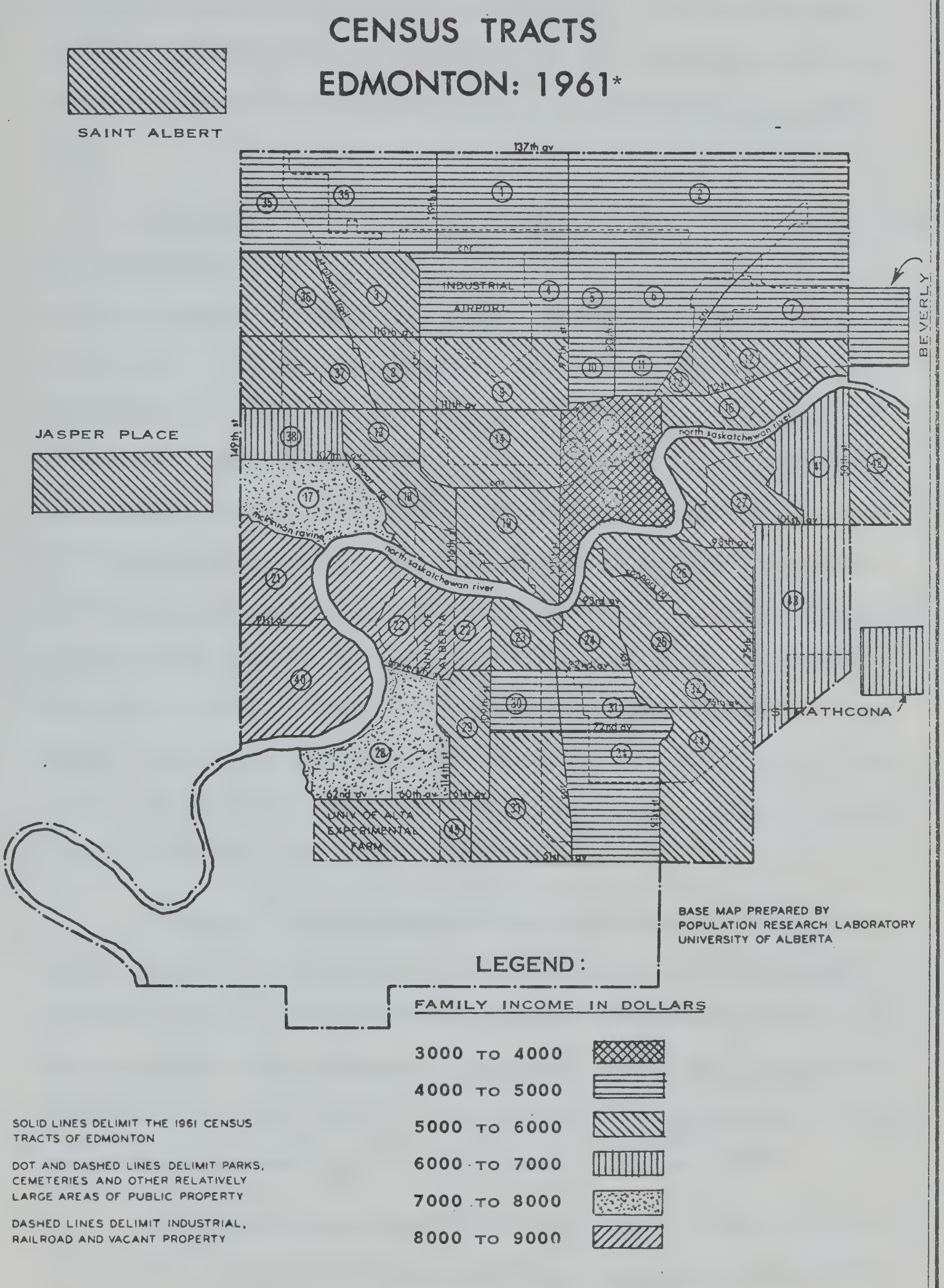

CENSUS TRACTS
EDMONTON: 1961*
SAINT ALBERT
JASPER PLACE
BEVERLY
STRATHCONA
INDUSTRIAL AIRPORT
UNIV OF ALBERTA
UNIV OF ALTA EXPERIMENTAL FARM
north saskatchewan river
mckinnon ravine
137th av
149th st
BASE MAP PREPARED BY POPULATION RESEARCH LABORATORY UNIVERSITY OF ALBERTA
LEGEND:
FAMILY INCOME IN DOLLARS
3000 TO 4000
4000 TO 5000
5000 TO 6000
6000 TO 7000
7000 TO 8000
8000 TO 9000
SOLID LINES DELIMIT THE 1961 CENSUS TRACTS OF EDMONTON
DOT AND DASHED LINES DELIMIT PARKS, CEMETERIES AND OTHER RELATIVELY LARGE AREAS OF PUBLIC PROPERTY
DASHED LINES DELIMIT INDUSTRIAL, RAILROAD AND VACANT PROPERTY

FIGURE 2.10. FAMILY INCOME EDMONTON 1961

* Source: Ref. 16.

on income will not be published until mid-1973. The analysis shows, however, a complication is anticipated for 1971 income data and thus the exclusion of it in the analysis is not considered too much of a loss.

Based upon FIGURE 2.10, showing the 1961 city income zones, total population and 1966 resident Edmonton students were compared as the ratio of students to total population, producing the results shown in TABLE II-16. The inherent assumption here is that income zones have been relatively stable to 1966, which appears to be a reasonably safe assumption. The results of this analysis are quite clear, showing resident student generation increases with increasing income as expected. This finding supports and clarifies the rural income versus student findings of this study (Ref. CHAPTER II, Part 2.2.1.(c)), in so much as demonstrating other clear cut relationships that can be shown when more suitable data is available. In this and other data there is a strong suggestion that the presence of The University of Alberta on the south side of Edmonton has conditioned a high proportion of resident students or their families to live there over the years.

In place of recent income data the 1970 Edmonton Real Estate Board, Multiple Listing Service (23), residential house sales data, were analyzed as to house values as shown on FIGURE 2.11 for the city. These data were cross referenced to the 1961 income zones for ease of comparison and proved similar in the case of areas developed as of 1961. New residential growth areas do, of course, carry new values.

Then, based upon the house value zones, (socio-economic indicator in place of current family income) 1966 total population and 1970/1971

TABLE II-16

RATIO 1966 RESIDENT EDMONTON STUDENTS TO 1961 TOTAL POPULATION BY FAMILY INCOME ZONES*

ANNUAL INCOME ($)	NORTH SIDE EDMONTON FACTOR	SOUTH SIDE EDMONTON FACTOR
3000 - 4000	.00495	-N/A-
4000 - 5000	.01125	.018560
5000 - 6000	.01801	.0243383
6000 - 7000	.02005	.025939
7000 - 8000	.02795	.07322
8000 - 9000	.036486	.101653

RATIO 1970 RESIDENT EDMONTON STUDENTS TO 1966 TOTAL POPULATION BY 1970 HOUSE VALUE ZONES*

HOUSE VALUES (INCOME EQUIVALENT ZONES)	NORTH SIDE EDMONTON FACTOR	SOUTH SIDE EDMONTON FACTOR
14000 - 18000 (3-4 Equiv.)	.011646	-N/A-
18000 - 20000 (4-5 Equiv.)	.014111	.042838
20000 - 22000 (5-6 Equiv)	.021997	.035520
22000 - 24000 (6-7 Equiv.)	.024588	.023805
24000 - 26000 (ANOMALIE)	.041729	-N/A-
26000 - 28000 (7000-8000 Equiv)	.042495	.0
28000 PLUS (8-9000 Equiv.)	.042495	.094467

* Note total populations used in ratios.

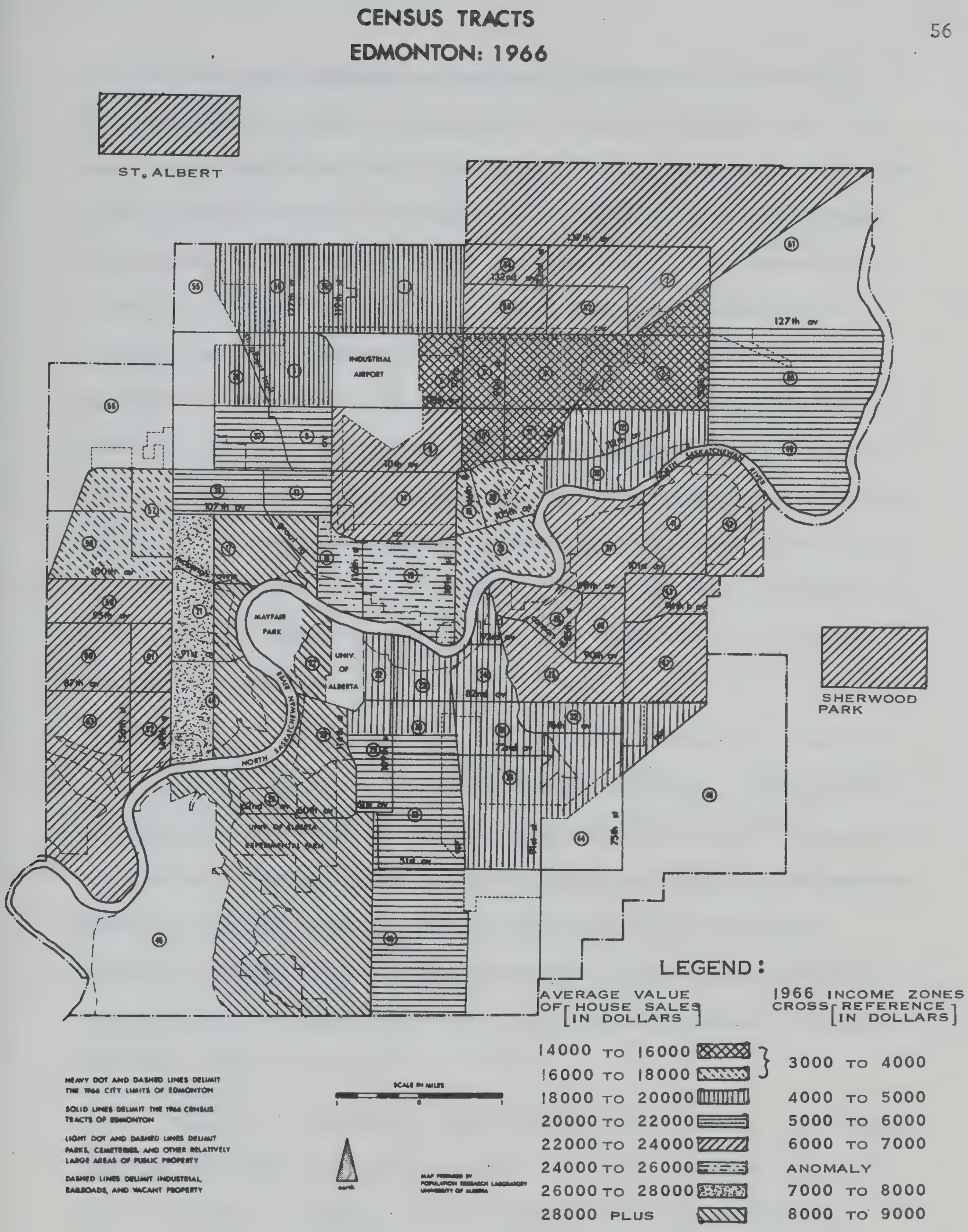

CENSUS TRACTS
EDMONTON: 1966
ST. ALBERT
SHERWOOD PARK
INDUSTRIAL AIRPORT
MAYFAIR PARK
UNIV. OF ALBERTA
UNIV. OF ALBERTA EXPERIMENTAL FARM
NORTH SASKATCHEWAN RIVER
137th av
127th av
132nd av
118th av
112th av
107th av
105th av
101st av
100th av
98th av
95th av
91st av
90th av
87th av
82nd av
76th av
72nd av
62nd av
60th av
51st av
127th st
118th st
109th st
101st st
156th st
149th st
73rd st
LEGEND:
AVERAGE VALUE OF HOUSE SALES [IN DOLLARS]
1966 INCOME ZONES CROSS REFERENCE [IN DOLLARS]
14000 TO 16000 ▩ } 3000 TO 4000
16000 TO 18000 ▨
18000 TO 20000 ▥ 4000 TO 5000
20000 TO 22000 ▤ 5000 TO 6000
22000 TO 24000 ▨ 6000 TO 7000
24000 TO 26000 ▨ ANOMALY
26000 TO 28000 ▨ 7000 TO 8000
28000 PLUS ▧ 8000 TO 9000
HEAVY DOT AND DASHED LINES DELIMIT THE 1966 CITY LIMITS OF EDMONTON
SOLID LINES DELIMIT THE 1966 CENSUS TRACTS OF EDMONTON
LIGHT DOT AND DASHED LINES DELIMIT PARKS, CEMETERIES, AND OTHER RELATIVELY LARGE AREAS OF PUBLIC PROPERTY
DASHED LINES DELIMIT INDUSTRIAL, RAILROADS, AND VACANT PROPERTY
SCALE IN MILES
1 0 1
north
MAP PREPARED BY POPULATION RESEARCH LABORATORY UNIVERSITY OF ALBERTA

FIGURE 2.11. EDMONTON HOUSE VALUE ZONES 1971*

* Source: Ref. 23.

resident Edmonton students were compared as the ratio of students to total population, producing the results as shown in TABLE II-16. For north side Edmonton the results are clear, showing resident students increase with house value. The one near exception to this well-defined relationship is the \$24,000 to \$26,000 house value zone (marked as an anomaly on FIGURE 2.11) where high-rise residential development has attracted resident students and others disproportionate to income equivalents. The south side, however, presents a different pattern likely for at least two reasons. First, house values in the \$18,000 to \$20,000 range zones do not reflect the presence of extensive walk-up and high-rise apartment developments and thus population density in close proximity to The University of Alberta. This counteracts the house value, and very likely the income parameter relationship of resident students to population.

Second, the greatly increased proportion of resident Edmonton students living away from their original Edmonton home is felt to have a bearing on disproportionate student generation close in to The University of Alberta. In summary, the new wave of married or emancipated resident Edmonton students, plus the density of housing opportunities for students and others close to The University of Alberta, likely will continue to upset what has been a very strong income parameter -- resident Edmonton student indicator.

The City of Edmonton income parameter as it relates to resident Edmonton University of Alberta students has thus been proven relevant and is thus held in abeyance for student population projection to follow.

2.3. Population Projections

2.3.1. General

The preceding analysis has in effect developed the rudiments of two simultaneous models for estimating future University of Alberta students. First, future provincial university students can be ascertained by use of the appropriate geographic based university social indices and for various assumed future Alberta populations and conditions. Second, for the City of Edmonton, future resident Edmonton University of Alberta students can be ascertained by use of the appropriate neighbourhood student generation factors for the assumed future population (60) and conditions and residential land use shape of the city. The simultaneous aspect of these two models, therefore, is to either balance the city model with the appropriate element of the provincial model, or vice versa. In this regard the city model is unquestionably the most accurate model for The University of Alberta. But the provincial model is certainly informative on university student distributions and potentialities throughout the province of Alberta.

This portion of the research, therefore proceeds on the basis of use of the most accurate information available at this time, on all parameters combined, to manually run these two models. In this regard the use of reliable demographic information the study has gleaned comprises an assumption of the study. An example would be the 1982 population assumed for Alberta by census divisions (24). A major assumption of the projection work to follow is that the retrogressive educational step of a declining University social index will not occur over the long run. (i.e. one decade to 1982). This is not to say that a given index may be taken as

non-increasing to 1982 due to projected conditions, which when taken with a declining population would generate fewer Albertan University students. In general, however, growth in Albertan University students is anticipated (12, 42) due to favourable projected educational and economic conditions in the province, particularly in urban areas.

It is appropriate at this point to mention that within the City of Edmonton the Northern Alberta Institute of Technology and the new Grant MacEwan Community College are also anticipating future growth. This study will therefore assess the impact these two institutions may have on The University of Alberta enrolment. It is assumed that the Athabasca University will continue to be a small pilot project in 1982 and will be a possible major development thereafter.

In conclusion, the purpose of the student and staff population projections is viewed in the research to be twofold. First, The University of Alberta student projections are done for the purpose of arriving at an unbiased research finding that will provide positive (or negative) support to the planned academic plan size of the university (49). Secondly, subject to the outcome of the first purpose, the purpose is first to summarize students, and then faculty and staff, to arrive at the university population projection in a form suitable to proper university transportation planning.

2.3.2. Provincial Albertan University Students

2.3.2.(a) Technical Description of Projection

The university social index method of the analysis portion of this chapter was developed to convert the relevant age group element of provincial population projections into Alberta university students for

campus planning purposes. Originally it was anticipated that a prominent reliable provincial population projection, carrying future age profiles per census division, would be found and used in the study. As no such fully detailed projection was found to exist at this time the following semidetailed work was done.

From the Seastone Report (42) the 1982 projected Alberta population was first determined by interpolation of appropriate tables. Then, in keeping with the detailed basis of the report, the population of six Alberta regions (Southern Region, Central, Mountain, Calgary, Edmonton, and Northern Region) was accumulated as shown on TABLE II-17. Next, the comparable, very current, George (24) populations were arrived at by distribution of his series B (assumed Median Fertility and Net Migration gain of 15,000 people per year in Alberta) population for 1982. Next, Seastone's (42) 1982 percentages of the 12 to 17 and 18 to 24 age groups by region were applied to the George populations (24) to arrive at the 15 to 24 age group for planning purposes, as shown in TABLE II-17. Note that this apparently complicated process was deemed the best way to obtain the most accurate appropriate age 15 to 24 detailed data, in the absence of a fully detailed provincial population projection.

Next TABLE II-18 showing the university social indices for six provincial regions was worked out from the information shown on TABLE II-9. Then, on the basis of ten years actual experience with university social indices per region, plus Seastone's (42) regional projected population and educational growth indication summarized on TABLE II-19, the 1981/1982 university social indices were calculated as follows. As TABLE II-19 shows that Southern and Central regions can anticipate little population growth and declining grades 7 to 12 numbers by 1982,

TABLE II-17

ALBERTA 1982 POPULATION PREDICTION FOR UNIVERSITY STUDENT PLANNING*

Alberta Census Division	Seastone 1982 Population	Seastone 1982 Population By Regions	George Comparative 1982 Population	Seastone 1982 Percent 12-17 & 18-24 Respectively	George Population Using Seastone Percent (1982)	University Student Planning Population 1982 15 to 24 Age Group ie: one-half Age 12-17 plus Age 18 to 24
1	40,866			9.80	17,095	
2	97,336	167,857	174,442	14.35	25,032	33,580
3	29,635					
4	13,702	Central Region				
5	35,212			9.94	27,872	47,332
7	42,126	269,836	280,403	11.91	33,396	
8	110,676					
10	68,120					
9	25,830	Mountain Region		10.70	6,293	
14	30,761	56,591	58,811	12.86	7,564	10,710
6	597,186	Calgary	620,614	9.80	60,820	
		597,186		13.17	81,735	112,145
11	709,962	Edmonton		10.00	73,782	
		709,962	737,815	13.52	99,753	136,644
12	76,802	Northern Region		11.11	28,230	
13	42,541	244,499	254,092	13.59	34,531	48,646
15	125,156					
TOTAL	2,045,931	2,045,931	2,126,177			389,057

* Source: Refs. 24, 42.

TABLE II-18

UNIVERSITY SOCIAL INDICES BY PROVINCIAL REGION, RATIO OF ALBERTA UNIVERSITY STUDENTS TO AGE 15 TO 24 CENSUS POPULATION GROUP

PROVINCIAL REGION	1961/62			1966/67			1971/72		
	STUDENTS	POPULATION	UNIVERSITY SOCIAL INDEX	STUDENTS	POPULATION	UNIVERSITY SOCIAL INDEX	STUDENTS	POPULATION	UNIVERSITY SOCIAL INDEX
Southern	572	22448	.02548	915	23811	.03843	2051	28904	.07096
Central	1038	33782	.03073	1621	37761	.04293	2097	40575	.05168
Mountain	138	5809	.02376	195	5930	.03288	325	7646	.04251
Calgary	1834	42449	.04321	3918	57028	.06870	7818	84503	.09252
Edmonton	3738	58466	.06393	6388	77941	.08196	12145	108201	0.11224
Northern	589	25204	.02337	837	28533	.02933	1147	33323	0.03442

TABLE II-19

SUMMARY OF SEASTONE POPULATION AND SCHOOL ENROLMENT OBSERVATIONS BY REGION*

A. Population

ALBERTA CENSUS DIVISION	PROVINCIAL REGION	OBSERVATIONS -- INDICATION OF POPULATION GROWTH PROJECTED TO 1982
1	Southern	1. Slight Growth
2	"	2. Substantial Growth (Lethbridge)
3	"	3. Decline
4	Central	4.
5	"	5. } Decline
10	"	10.
7	"	7. Stable
8	"	8. Substantial Growth (Red Deer)
9	Mountain	9. Growth
14	"	14. Growth
6	Calgary	6. Great Growth
11	Edmonton	11. Great Growth
12	Northern	12. Substantial Growth
13	"	13. Decline
15	"	15. Substantial Growth

B. Actual and Projected Grades 7 to 12 School Enrolments

CENSUS DIVISIONS	REGION	NUMBER OF STUDENTS					
		1970/71		1981		2005	
		No.	%	No.	%	No.	%
1,2,3	Southern	20577	10.6	17000	8.2	18899	6.3
4,5,7,8,10	Central	32358	16.8	27524	13.3	28760	9.6
9,14	Mountain	5057	2.6	5781	2.8	8142	2.7
6	Calgary	45047	23.4	57028	27.7	99410	33.2
11	Edmonton	62788	32.6	70229	34.1	109140	36.5
12,13,15	Northern	27057	14.0	28552	13.9	34930	11.7
	Total	192884	100	206114	100	299281	100

* Source: Ref. 42.

university social indices and/or university participation rates were kept flat from 1970/1971 to 1982. Regarding this assumption the study notes that Lethbridge and Red Deer are anticipated to have strong population and student growth yet possibly not sufficient to offset the relevant regional declines. It is also relevant to note that the U-factor analyses of this chapter (Ref. 2.2.1.(a)) has shown a problem, particularly in Central region, in attracting qualified students into the Alberta university system.

On the other hand, as the remaining four provincial regions can anticipate substantial growth in population and grades 7 to 12 students, the average growth in university social indices over ten years (1961 to 1971) was applied to the 1970/1971 indices to arrive at the 1981/1982 university social indices. In this regard the application of a ten year average growth per region is, of course, more conservative than use of the 1966 to 1971 period only, which helps compensate for the recent two flat growth years (Ref. TABLE II-1).

Finally, the newly arrived at 1981/1982 regional university social indices were multiplied by the 1982 projected Alberta population for university student planning purposes to obtain 1981/1982 Albertan University students (Ref. TABLE II-20). Lastly, on the basis of the observed ten year distribution of Alberta students amongst three universities (Ref. TABLE II-8), an estimate of The University of Alberta's share was made to arrive at the provincial estimate of the university's 1982 students.

TABLE II-20

1982 ALBERTAN UNIVERSITY OF ALBERTA STUDENT

POTENTIAL UNIVERSITY SOCIAL INDEX METHOD

PROVINCIAL REGION	1981/82 UNIVERSITY SOCIAL INDEX	1982 AGE 15 TO 24 POPULATION	ALBERTAN UNIVERSITY STUDENTS	ESTIMATED U OF A SHARE %	1982 ALBERTAN - UNIVERSITY OF ALBERTA POTENTIAL STUDENTS
Southern	.07096	33580	2383	15	358
Central	.05168	47332	2446	50	1223
Mountain	.06121	10710	656	50	328
Calgary	0.14184	112145	15907	8	1273
Edmonton	0.16054	136444	21937	97.5	21389
Northern	0.04548	48646	2212	85	1880
Total	0.11712	388857	45541	58.1	26451

2.3.2.(b) Discussion of Provincial Projection

It is apparent to the researcher, and hopefully the reader, that the matter of predicting future university students is a very complicated affair. This project yields new insight into the problem, however, by recognizing geographically differentiated and varied university student generations in the use of University Social Indices, supported by U-Factor and income analysis observations. Thus, for example, theoretically, if the population of the province were to stay equal for a time, but experience an urban shift, university students would increase in number, other things remaining equal. For this reason alone projection methods which combine all Alberta students with no geographic differentiation are very likely inaccurate to some unknown degree. Regarding determinants of university enrolment, the chief one is a function of the 17 to 24 (15 to 24 used because of time limitations) age population group, but increasingly of the over 24 cohort.

The school enrolment research of this chapter (Ref. 2.2.1.(a)) shows that high school performance is a major factor in the generation of qualified university students. In this regard, since the time of the first analysis, 9,665 Alberta grade 12 students matriculated in 1971 (26), which was approximately 1,000 more than expected, thus supporting the thesis contention that they stayed back in high school longer. Soon, this resurgence in matriculants will, no doubt, favourably affect provincial university enrolments.

Regarding the age 24 plus cohort mentioned above, oddly enough, only University of Calgary (U. of C) has started to keep age profiles of university freshmen specifically (35). In this regard in 1971/1972,

5.6% of freshmen were 24 years old or more. University of Alberta would likely be at least equal. For both U. of A. (36) and U. of C. (35), over 27% of all full-time, day, winter session students were 24 years old or more and, naturally, the two well developed Graduate Studies Faculties, which generally deal with older students, are involved. In short, as the 24 plus cohort (freshmen or new graduate students) are mostly not new matriculants, and with any further future relaxation of university entrance method, or changes to the basis for determining "matriculation" or equivalent, the future population oriented, university social index method will become more relevant as opposed to a provincial cohort survival model based on well past grade school enrolment and performance.

Regarding the key parameter, population, the two population projections used (24, 42) fully recognize recent declining provincial birth rates, young and old mortality rates, age specific fertility rates and net provincial migration. In a compatible fashion, the Seastone study (42) recognizes an absolute decline of 6% in the elementary school age group (age 6 to 11) from 1970 to 1980 as well as an absolute decline in the 12 to 17 age group of 10% from 1975 to 1980. Beyond 1980, both age groups are expected to experience continuous increases. The decline in grade school populations above, however, are expected to be reflected in a subsequent decline in the post secondary age groups and possibly, therefore, university enrolment from 1980 to 1990 followed by increases. Although this strongly appears to be the case, the research at hand would have us believe that it also depends on the distribution of the population at that time and university social indices of the day. For this reason, the university social indices used in the current projection

were kept constant from 1971/1972 to 1981/1982 in Central and Southern regions where the anticipated post secondary educational declines may have greatest impact. The U-factor research earlier in this analysis (Ref. 2.2.1.(a)) supports this move as there is a problem in these provincial areas, with university students to matriculant ratios being off the provincial average (Ref. TABLE II-6). The four other provincial regions will clearly react quite oppositely and university social indices used were allowed to grow.

Further regarding population, a few brief interesting observations are in order. Obviously the previous forecasting eluded to the anticipated increasing dominance of Edmonton and Calgary, which are anticipated to have 60% of the provincial population by 1980. These cities carry very high university social indices. Additionally, Seastone (42) reports that urban places (places of population 1,000 or more) will account for an estimated 80% of the Alberta population by 1980 and by then the urban-rural transition is anticipated to be substantially accomplished. Regarding TABLE II-19, the close proximity of Calgary and Edmonton to areas of Central region explains, in large part, the population declines by emigration to the province's two major urban centres. Through developments of minerals, forestry and tourism, Mountain regions' population will increase and should continue to have surprisingly good income. Seastone (42) further reports that the vast Northern region will increase in population (Ref. TABLE II-19) but not necessarily in population density. Most important however, the age 5 to 17 group are anticipated to grow and align more closely with provincial averages. Additionally, the excess of males over females will decline consistently, all of which

implies increasing normal family formation and activities in the region. This area is of great interest to The University of Alberta and long term growth in university age people appears indicated, which the research at hand reflects in improvements in university social indices to 1981/1982.

Regarding the income parameter, the TABLE II-11 analysis showed that in spite of the 1970 recession, Alberta average income increased. Yet, while urban oriented census divisions were experiencing expanding average income, agriculturally oriented census divisions were experiencing some declines. Further, the fact that the latter declines were so detrimental to Alberta University enrolments immediately suggests the great difficulty in working with, and indeed projecting, income meaningfully. Additionally, the number of people unemployed at any given time must be considered along with income, in addition to distribution to social groups of the income (Ref. 2.2.1.(c)).

The net effect of these kinds of research observations suggests several possibilities in coming to grips with the problem. First, we can examine the provincial record and find Alberta's personal income in current dollar values increased more than three times from $930 million in 1950 to $2.9 billion in 1965 (42). Second, we can examine knowledgeable projections which on the basis of an annual real growth rate of 5% and a price inflator of 2.5% puts total personal income at $3.4 billion in 1970 and $5.5 billion in 1980 in current dollars (42). In this regard, a recent Canadian regional economic survey (51) is appended (Ref. APPENDIX I). And third, we can make an appropriate assumption that Alberta will experience, over the period of relevance of this study,

increasing growth in personal income and general provincial prosperity in relation to the other provinces. As the last recession in Alberta was a decade ago, in 1961, this assumption is not actually bad, assuming general recessions run in about ten year cycles. And fourth, if time would allow, we could find or suggest as to better measures of Alberta's economic performance by census divisions as it relates to explaining university student generation.

Concluding income, however, the research should reemphasize the vulnerability of universities to general recessions, particularly those coupled with big agricultural problems (5, 6, 45, 67). This obviously must work in many ways, two widely opposite ways being insufficient family income and/or resource welfare to send a son or daughter to university and the drying up of the graduate job market thus reducing student incentive. The research views The University of Alberta as serving the Northern half of Alberta which is an area more subject to rural income problems than the South; rural income may well continue to be a problem (63) (Ref. APPENDIX I).

Concluding, the provincial Albertan University student projection just completed is a more conservative estimate than referred to by Seastone (42) or possibly by Worth (12) when appropriate non-Albertan students are added in Section 2.4 of this chapter.

2.3.3. City of Edmonton (Metro)

2.3.3.(a) Technical Description of Projection

The resident Edmonton neighbourhood student generation factors method, developed earlier in the analysis, is the method employed in performing the following projection (Ref. 2.2.2.(b)).

First, from the consolidated version of the City of Edmonton General Plan (57), the city's 1981 population distribution was obtained as shown on FIGURE 2.12 following. Additionally, TABLE II-21 was obtained giving the compatible metropolitan Edmonton area population projection for 1981. As, in essence, the projection method to be employed depends upon people, accounted for on a neighbourhood basis, considerable research was done at the City Hall Planning Department to obtain the best information available at this time as to how the city, and particularly the new residential areas, will develop. In this regard, TABLE II-22 was made to show the six outline plan areas (7, 8, 9, 39, 43, 66) of active and proposed city growth to 1981 (57). Further in TABLE II-22 the age of subdivision research (Ref. 2.2.2.(c)) was brought to bear by omitting the population of probable neighbourhood units that will have student Lag Factors inappropriate for university student generation by 1981/1982. Students generated by these few neighbourhoods to be developed at the end of the decade (1981/1982) will arrive at the U. of A. after the forecast period.

With the upcoming city neighbourhoods resolved in the long run as best as was possible, and hereby assumed as good input information, attention was then given to equating the other 1966 census tract arrangements used in the analyses with the population areas of FIGURE 2.12 to arrive at the required 1981 population per planning tract. TABLE II-23 summarizes these results which, when combined with developing areas (Ref. TABLE II-22), effectively reduces the 1981 population of Edmonton from 626,000 (Ref. TABLE II-21) to 584,700 people for university planning purposes. In this regard, on the basis of semi-logarithmic plots (Ref. APPENDIX I) for St. Albert and Sherwood Park,

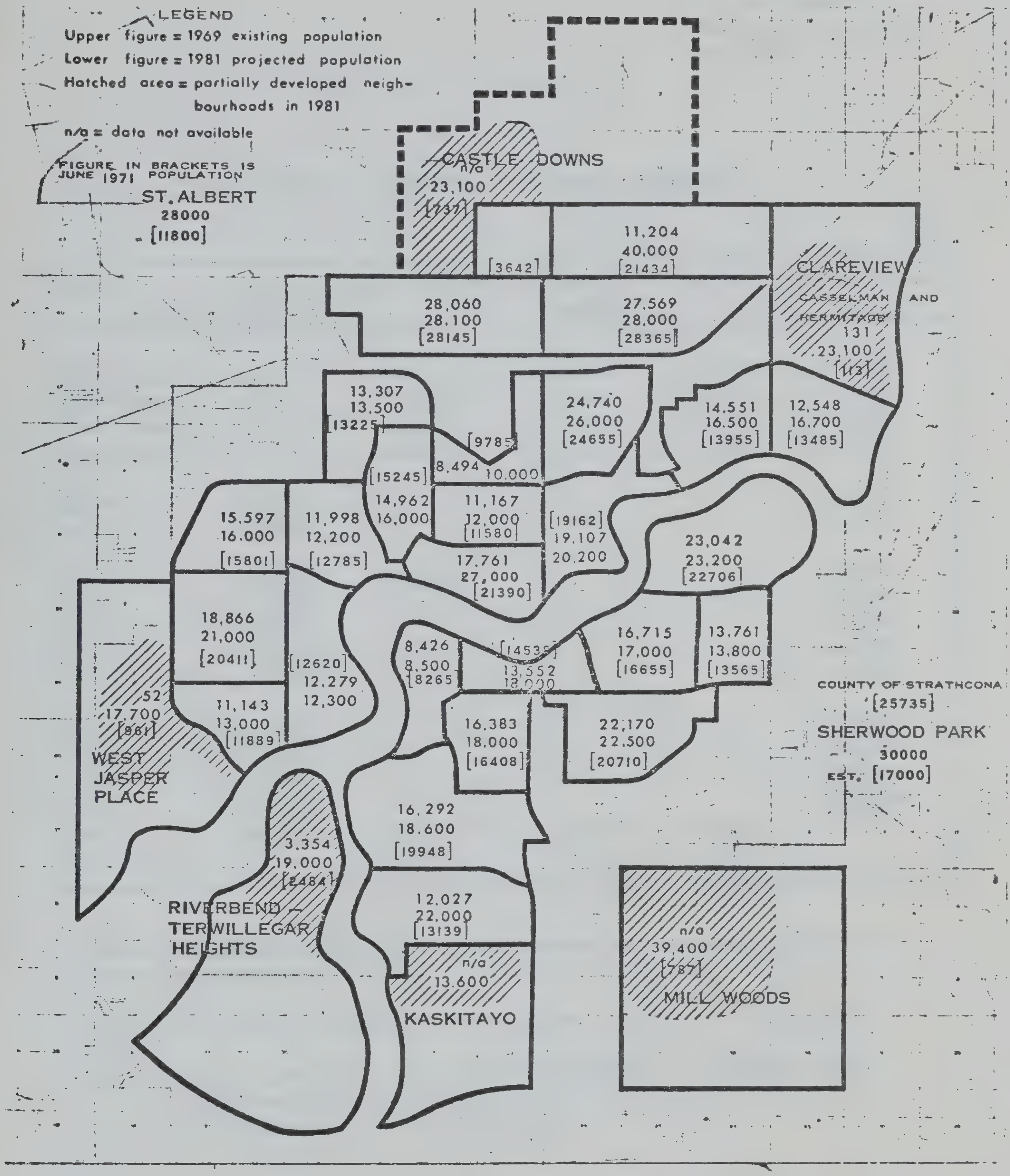


FIGURE 2.12. EDMONTON GENERAL PLAN POPULATION DISTRIBUTION 1981*

* Source: Ref. 57.

City of Edmonton
Planning Department
May, 1970

TABLE II-21

METROPOLITAN EDMONTON POPULATION FORECAST*

Year	City of Edmonton	St. Albert	Sherwood Park	Rural	Metropolitan Total
1966 (Fall)	381,330	9,828	6,200	9,090	406,448
1967 (Fall)	393,563	10,243	7,000	9,484	420,290
1968 (Fall)	410,105	10,191	7,500	11,300	439,096
1969 (Fall)	422,418	10,530	10,000	11,600	454,548
1970**	430,000				464,000
1971	445,000				482,000
1972	460,000	15,000			500,000
1973	477,000				520,000
1974	493,000				540,000
1975	509,000				560,000
1976	525,000				580,000
1977	544,000				603,000
1978	563,000				626,000
1979	582,000				649,000
1980	601,000				672,000
1981	626,000	35,000⊕	25,500⊕	14,500	701,000

* Based on population projections prepared by the Edmonton Regional Planning Commission.

** From 1970 onwards figures are projected for June of each year.

⊕ NOTE: Semi-logarithmic plots (Ref. APPENDIX I) indicate these estimates should be 28,000 and 30,000 for St. Albert and Sherwood Park respectively.

TABLE II-22

CITY OF EDMONTON OUTLINE PLANS AND POPULATION FOR UNIVERSITY PLANNING PURPOSES AND SOCIO ECONOMIC INDICATION

Outline Plan and Estimated Population to 1981/1982	Estimated Subdivision Units Timing and Population (Note for population in squares no substantial university student generation by 1981/1982 is anticipated)						Estimated Population for University Planning to 1981/1982	Income (57) and Similar Neighbour-hood Reference	Relevant Student Lag Factor* (years)
Castle Downs		1973	1975	1977	1979	1981		Middle-Lower Middle	
23,100		3000	3600	4500	$\boxed{6000}$	$\boxed{6000}$	11,100	Dickensfield Steele Heights	4 - 7
N.E. Clareview Hermitage Castleman		1973	1975	1977	1979	1981		Middle-Lower Middle	
23,100		6000	6000	4500	$\boxed{4500}$	$\boxed{2100}$	16,500	Rundle Heights Steele Heights	4 - 7
Millwoods	1972	1974	1976	1978	1980	1982		Middle-Lower Middle	
39,400	6000	6000	6000	6000	$\boxed{6000}$	$\boxed{9400}$	24,000	St. Albert	5 - 6
Kaskitayo		1974	1975	1977	1979	1981		Middle-Upper Middle	
13,600		2000	2500	3000	3000	$\boxed{3100}$	10,500	Petrolia	2 - 3
Riverbend	1972	1973	1975	1977	1979			Upper-Middle High	
19,000	3000	3000	4500	4500	4000		19,000	Riverbend	2 - 3
West Jasper Place	1972	1974		1977		1980		Middle-Upper Middle	
17,700	4500	4500		4500		$\boxed{4200}$	13,500	Patricia Heights	5 - 6
St. Albert Sherwood Park	Handle on a continuous basis like established subdivisions								
135,900	Total People				- 41,300	=	94,600		

* (Reference TABLE II-15).

the research indicated changes in projected population to 28,000 and 30,000 respectively were in order. TABLE II-23 uses these latter figures and not the Edmonton Regional Planning Commission figures of TABLE II-21, the basis of which is unknown.

The final step in the 1981 population work was to calculate and utilize the percentage of age 15 to 24 people from the relevant planning tract information of the 1971 census population (47), assumed to give a close approximation of the 1981/1982 age 15 to 24 group for university planning purposes. Subsequently, this assumption will be checked out for validity.

At this point in the projection, careful research observations respecting the five stage University Student Neighbourhood Generation Cycle and related university social indices were made as follows. First, for all the planning tract arrangements, population growth to 1971, in relation to anticipated growth to 1981, were observed to obtain information on population growth patterns. More specifically, some planning tracts have already passed their 1981 projected population, while most are either growing towards it as expected or have arrived and are stabilizing (Ref. FIGURE 2.12). Next, on the basis of the semi-logarithmic population and student plots which were examined in great detail, coupled with the above overall city population observations, The University Student Neighbourhood Generation Cycle was "advanced" one decade. FIGURE 2.13 summarizes the anticipated 1981-1982 population and University Student Neighbourhood Generation Cycle by observing planning tract arrangements in the appropriate student generation stage.

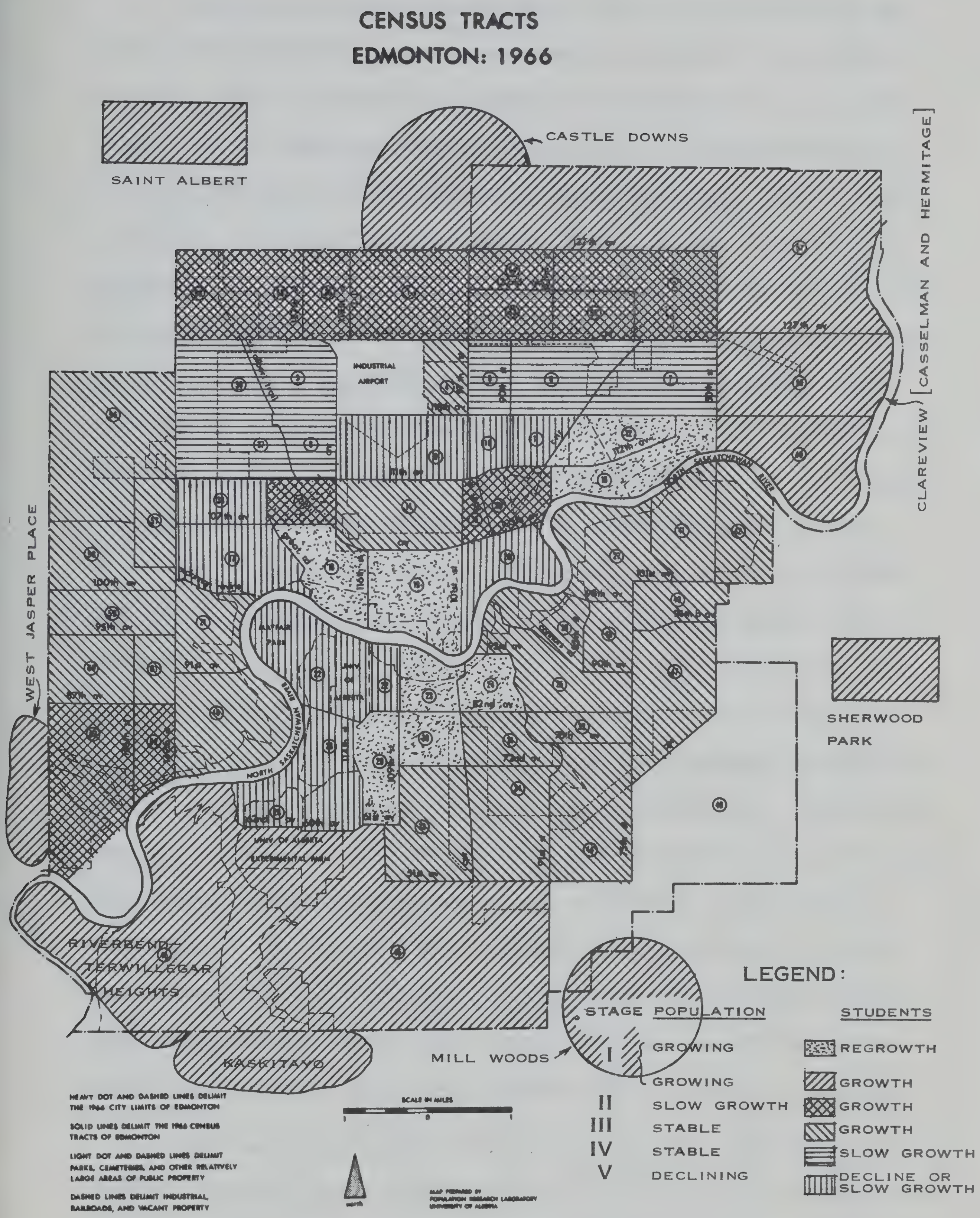

CENSUS TRACTS
EDMONTON: 1966
SAINT ALBERT
CASTLE DOWNS
CASSELMAN AND HERMITAGE
CLAREVIEW
WEST JASPER PLACE
INDUSTRIAL AIRPORT
NORTH SASKATCHEWAN RIVER
UNIV. OF ALBERTA
UNIV. OF ALBERTA EXPERIMENTAL FARM
SHERWOOD PARK
RIVERBEND–TERWILLEGAR HEIGHTS
KASKITAYO
MILL WOODS
LEGEND:
STAGE
POPULATION
STUDENTS
I GROWING ▨ REGROWTH
GROWING ▨ GROWTH
II SLOW GROWTH ▨ GROWTH
III STABLE ▨ GROWTH
IV STABLE ▤ SLOW GROWTH
V DECLINING ▥ DECLINE OR SLOW GROWTH
HEAVY DOT AND DASHED LINES DELIMIT THE 1966 CITY LIMITS OF EDMONTON
SOLID LINES DELIMIT THE 1966 CENSUS TRACTS OF EDMONTON
LIGHT DOT AND DASHED LINES DELIMIT PARKS, CEMETERIES, AND OTHER RELATIVELY LARGE AREAS OF PUBLIC PROPERTY
DASHED LINES DELIMIT INDUSTRIAL, RAILROADS, AND VACANT PROPERTY
SCALE IN MILES
1
0
1
north
MAP PREPARED BY POPULATION RESEARCH LABORATORY UNIVERSITY OF ALBERTA

FIGURE 2.13. POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE 1981/1982

Having thus advanced the student cycle to 1981/1982 there remained but to then calculate the appropriate university social indices which was done, as follows, for planning tract arrangements in growth stages 1 to 3. From each semi-logarithmic plot of resident Edmonton students, the ratio of the students to appropriate age 15 to 24 population was calculated for 1966 and for 1970. At this point the difference in the two social indices was obtained and this was divided by six, and not four, years as a conservative measure to account for two recent years (1971 and 1972) of no U. of A. enrolment growth. Then, this arrived at amount was multiplied by eleven (years) and added to the appropriate 1970/1971 university social index per planning tract to get the index for 1981/1982 summarized for all planning tracts on TABLE II-23. All growth social index calculations are appended (Ref. APPENDIX I). With respect to university social indices for stages 4 and 5, students are expected to decline or incur slow or low growth and population is expected to decline respectively. This is not to say that there will not be substantial numbers of resident Edmonton University of Alberta students originating in declining neighbourhoods. Rather, what is being suggested is that the absolute numbers will be past their peak when viewed on historic semi-logarithmic plots (Ref. sample plots, APPENDIX I). Thus the 1970/1971 university social indices were used for relevant tracts in 1981/1982. Again, as for the provincial projection, the assumption here is that, in the long run, the retrogressive educational step of a declining university social index will not occur.

And lastly, university social indices for new areas were arrived at from a research understanding obtained at City Hall as to the likely socio-economic characteristics of new and proposed city areas (57)

TABLE II-23

METROPOLITAN EDMONTON 1981/1982

UNIVERSITY OF ALBERTA STUDENT POTENTIAL

1966 CENSUS TRACTS	1981 U. PLANNING CITY POPULATION	% AGED 15 TO 24	AGE 15 TO 24 GROUP	1981/82 UNIVERSITY SOCIAL INDEX	UNIVERSITY STUDENTS	97.5% UNIVERSITY OF ALBERTA STUDENTS
56 - 59	16,000	21.31	3410	.11530	393	383
60 , 61	21,000	20.86	4381	.16596	727	709
62 , 63	13,000	14.32	1862	.24523	457	446
West J.P.	13,500	17.59	2375	.14667	348	339
Riverbend	19,000	21.45	4076	.27586	1124	1096
Kaskitayo	10,500	13.43	1410	.22180	312	304
45	22,000	15.51	3412	.36669	1251	1220
28,33	18,600	22.42	4170	.33370	1392	1357
29,30	18,000	26.10	4698	.24920	1171	1142
22	8,500	33.55	2852	.33370	952	928
23,24	18,000	29.91	5384	.23173	1248	1217
21 & 40	12,300	19.85	2442	.34979	854	833
17 , 38	12,200	20.69	2524	.17059	431	420
13 , 8	16,000	23.63	3781	.23173	876	854
18 , 19	27,000	27.77	7498	.23173	1737	1694
14	12,000	35.66	4279	.23173	992	967
4	10,000	36.09	3609	.10454	377	368
3, 36, 37	13,500	23.54	3178	.10960	348	339
1, 35, 55	28,100	17.09	4802	.11488	552	538
B.A.C.M.	11,100	13.18	1463	.10668	156	152
51	40,000	13.18	5272	.10668	562	548
2, 52, 54	28,000	16.55	4634	.08761	406	396
Hermitage	16,500	13.18	2175	.10668	232	226
5, 6, 10, 11	26,000	19.91	5177	.07030	364	355
12, 16	16,500	18.36	3029	.14777	448	437
49, 50	16,700	17.83	2978	.08761	261	254
15, 39, 20	20,200	18.80	3798	.06014	228	222
27, 41, 42	23,200	17.74	4116	.19857	817	797
25, 26, 48	17,000	21.99	3738	.18092	676	659
43, 47	13,800	16.60	2291	.15652	359	350
31, 32, 34,44	22,500	21.56	4851	.16710	811	791
Millwoods	24,000	14.80	3552	.10828	385	375
Sh. Park	30,000	14.80	4440	.10828	481	469
St. Albert	28,000	13.73	3844	.19023	731	713
Rural Routes	14,500	17.81	2582	.09872	255	249
TOTAL	657,200	19.49	128,083	.17734	22,714	22,141

(Ref. TABLE II-22). Thus for Riverbend the 1970 index was used for 1981, for West Jasper Place the tracts 60 to 63, 1970 index was used, for Kaskitayo the Greenfields 1970 index was used, and for Castle Downs Clairview, Castleman and Hermitage, the 1981 Steele Heights index was used. Millwoods and Sherwood Park are predicted to use the St. Albert 1970/1971 index. On the later one, Sherwood Park has been a slow university student generator to date (Ref. TABLE II-14) but is expected to accelerate. Millwoods, being not far from Duggan or Greenfields, is also expected to behave somewhat like a similarly classed South Side subdivision respecting university student generation, which is similar to the chosen index. Housing developments in Millwoods are, of course, well under way and being occupied at the time of writing this report.

Having thus obtained the required university social indices in a form relevant to population (FIGURE 2.12), the next step was to multiply them by the appropriate projected age 15 to 24 population group to arrive at The University of Alberta, resident metropolitan Edmonton student enrolment potential for 1981/1982 (Ref. TABLE II-23), being 97.5% of the full student potential of 22,714 or 22,141 students. The remaining 2.5% will likely attend the Universities of Calgary and Lethbridge (Ref. TABLE II-8).

2.3.3.(b) Discussion of Metropolitan Edmonton Projection

In view of the fact that metropolitan Edmonton will continue to be the prime source of The University of Alberta's student enrolment considerable attention has been given to the anatomy of the city respecting university student generation. The student projection just completed viewed the city in a number of 1966 census planning tract

arrangements, which in effect represents an analysis to the neighbourhood and/or relatively homogeneous socio-economic level of detail. The critical elements of this new approach to the problem will now be discussed.

Again, as for the provincial university student projection, anticipated population growth including inherent age group characteristics is the most critical element of the method, being the major determinant of student generation. In this regard the City of Edmonton population projection (57) has been used, plus a conservative version of the St. Albert and Sherwood Park population projection, all monitored very closely back to the related 1956 Federal census (19) (Ref. APPENDIX I semi-logarithmic plots). The metropolitan and City of Edmonton population projections to 1981 (Ref. FIGURE 2.12 and TABLE II-21) are based upon economic base studies undertaken by the Edmonton Regional Planning Commission in 1958 and updated in 1962, and again in 1969. As the Provincial Planning Act requires update of general plans every five years, the City Planning Department, in anticipation of this, have prepared two more Edmonton population studies (59, 60). An examination of these show that they will, like the current General Plan population projections, fit well with the provincial population projection used, adhering to compatible assumptions. In this regard the City of Calgary population projection (52) is also compatible thus indicating reasonable levels of confidence in planning with major population estimates.

An interesting point regarding the projection method being discussed is the treatment of new, developing and planned city areas as they relate to University of Alberta student generation. In essence,

the earlier student Lag Factor research of this chapter (Ref. 2.2.2.(c)) provided the basis upon which TABLE II-22 effectively eliminates 41,300 anticipated 1981 population from the projection calculations summarized on TABLE II-23. This is, of course, quite a substantial population reduction, yet longer term student Lag Factors indicate the subdivisions holding the projected 41,300 population will likely not be generating substantial numbers of university students by the 1981/1982 university year. The inherent assumption here, though, is that the recent phenomena of higher socio-economic student Lag Factors dropping to 1 to 2 years (e.g. in Lansdowne and Rio Terrace, Ref. TABLE II-15) will not occur in the forecast decade. If it did occur, potentially more university students would be generated, assuming the accuracy of the population projections. The effective deletion of 41,300 population for university planning purposes may be viewed as a conservative measure which helps compensate for possible problems city planners have in forecasting city growth.

Regarding income and population, an anticipated continuance of two decades prosperity in Alberta is an inherent assumption in the population projections used. This will be discussed in due course.

Another critical element in the City of Edmonton University of Alberta student projections to 1981/1982, is the so called University Student Neighbourhood Generation Cycle previously described in detail. More specifically, the critical portion of this research is not the fact that actual semi-logarithmic plots, of city census tract populations and university students to 1971, sort out into five quite readily identifiable groups. Neither is the fact that the current and past university

social indices are known, the critical aspect. Rather, the critical aspect is the predictive aging of city planning tracts, or advancing the University Student Neighbourhood Generation Cycle, complete with then supplying the appropriate university social indices. In this regard, having seen what has happened to the planning tracts respecting population and university student generation, from 1956 to present and into 1981 via a reputable population projection, in fact adds confidence and good insight into the cycling process.

In this regard a look at the Family Life Cycle (25) and the Neighbourhood Residential Development Cycle (31) will be helpful. The salient features of these two cycles plus the University Student Neighbourhood Generation Cycle are summarized on TABLE II-24 with each phase or stage having been placed opposite the relevant phase or stage of adjacent cycles.

The Family Life Cycle (25), in essence, says the following respecting the situation at hand. Generally, young people start off the cycle with marriage, leading to the child bearing phase of their relationship generally within a few years. This phase progresses until the family is completed in 10 years or less (Glick (25) found 6 years average) and the experience of all family members at home continues. Eventually children grow up and begin to leave home to work, go to college, get married, etc., thus entering the children leaving home phase which can, on occasion, overlap the proceeding phase. Finally, all the children have left home and there then follows a time, possibly from 45 , or 50, to 70 years of age, when the original married couple enjoy changing economic status and the good married life. This period

TABLE II-24

A COMPARISON OF THE UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE TO TWO RELEVANT CYCLES*

University Student Neighbourhood Generation Cycle	Family Life Cycle	Neighbourhood Residential Development Cycle
Stage 1 Regrowth - Population and Students	A. Marriage	Stage 5 Renewal
Growth - Population and Students	B. Childbearing	Stage 1 New Single-Family Subdivisions
Stage 2 Slow Population Growth - Students Growing		Stage 2 Apartment Development
Stage 3 Stable Population - Students Growing Stage 4 Stable Population - Students Slow Growth	C. Children Leaving Home	Stage 3 Down-Grading Generally Associated with Conversion
Stage 5 Declining Population - Students Declining or Slow Growth	D. Dissolution of the Family	Stage 4 Thinning Out

* Source: Refs. 25, 31.

has dramatically lengthened in the past two to three decades. Eventually, dissolution of the family occurs through death.

In terms of the population planning of the study at hand the Family Life Cycle (25) is further indicating the following. Marriage finds young newlyweds, often university students, situated in city high-rise or walk-up apartment neighbourhoods as their space needs etc. are minimal. These areas are usually convenient to places of work, with access to recreational facilities "where the action is", and can have increasing population density. Child bearing finds married couples with additional space and privacy needs, usually satisfied in due course in single family dwellings in new peripheral city neighbourhoods where down payments on housing are most attractive. These areas are characterized by rapid population growth as has been seen in this study. Gradually, as the occupancy of a new subdivision is complete, population growth moderates, and as child bearing is completed, population stabilizes. University student generation, of course, starts 18 to 20 years after marriage, which puts it no more than 7 years after occupancy of new Edmonton neighbourhoods (Ref. FIGURE 2.9). Quite obviously, even as population growth in neighbourhoods comes into stability, children already born progress on up and through the university system. Gradually, neighbourhoods, and the people therein, age and progress with children leaving home, gradually leading into declining population unless the neighbourhood accepts suites and conversions and new people. In due course, declining population continues as all children grow up and leave home, leading to dissolution of the family. Concluding population and the Family Life Cycle (25), this is obviously exactly what is going on in the University Student Neighbourhood Generation Cycle for the

City of Edmonton.

The Residential Development Cycle (31) dovetails into the previous cycles as follows. Stage 5, renewal, characterizes the end of deteriorating old housing stock and redevelopment of high-rise and/or multiple family dwelling units. Immediately, for Western Canadian cities, this implies central city areas where neighbourhoods have had time enough to get old. And thus this stage in Edmonton, which is a recent phenomena (started 1955 -- Savoy Plaza apartment hotel (58)), has occurred close in to the Central Business District and The University of Alberta, figuring prominently in the stage 1, regrowth, phase of the University Student Neighbourhood Generation Cycle.

Stage 2 of the residential cycle represents the development of single family detached dwelling units or new city neighbourhoods. These, generally, are located where serviced land is available at the city's edge, aimed at the needs of growing families who need more space and privacy, new and improved child raising environments, or increased social contact or status. These areas are characterized by rapid population growth (child bearing) and generation of many university students in due course.

Stage 2 of the residential cycle is characterized by the development of apartments and/or multiple family dwellings across city areas often completing land use. Early old walk-ups found here and there in Edmonton are examples as are newer developments like Lord Byron Place or Meadowlark Village (58). This adds to the impetus of subdivision population growth and university student generation.

Stage 3 of the Residential Cycle sees the gradual downgrading of housing stock, often through conversions, renovations, etc. leading to increased population density and even crowding, assuming all land use in a given residential area continues as residential. This process often occurs in older central city neighbourhoods, often being areas that offer a foothold to new city arrivals. Here population may be growing or simply stabilizing but may be generating university students often in need of this form of upward mobility.

Stage 4 of the Residential Cycle, which is an advanced phase of stage 3, is characterized by shrinkage in size of families and/or households, or thinning out. This leads to population decline and often neglect for required essential maintenance of housing stock, leading to renewal, stage 5.

In conclusion, the three cycles just discussed are in many respects different facets of the same overall human life process. The residential housing needs of families in the Family Life Cycle are well known (32) and the University Student Neighbourhood Generation Cycle simply follows the Family Life Cycle. It is prudent to point out that the Student Cycle is potentially unique, however, in that students can increase in declining neighbourhoods through good economic housing potential, and that high-rise apartment redevelopment, say, close to The University of Alberta, does not of itself insure student regrowth. In short, evidence exists that close-in luxury apartment developments are getting out of student financial reach through other demand. Coincidentally, this would imply more commuting.

Concluding the critical estimates of the city projection, the university social index estimates have been described previously and do follow The University Student Neighbourhood Generation Cycle. Growth indices carry more confidence than non-growth indices. However, as only two indices (Ref. TABLES II-14 and II-23) exceed recorded index magnitudes, the estimates are felt to be reasonable and the best that can be done at this time. New city areas have been duly matched with similar socio-economic neighbourhoods, and university social indices were applied which recognize age of subdivision (Ref. 2.2.2.(c)) as it relates to student generation.

The last item to be discussed under city projections is the income parameter. The analysis showed that university student generation increases with family income but that the recent, close in to university apartment development living opportunities are distorting the parameter and rendering the inherent indices unprojectable. The fact of the matter is, however, that the university social indices (Ref. TABLE II-23) do in fact capture much the same facts, due to the differential student generations of the various neighbourhoods; and these indices are suitable for prediction work. Additionally, new neighbourhoods have been given suitable socio-economic university social indices based upon recorded university experience in similar neighbourhoods.

The question as to the continued prosperity in Alberta, reflected in university social indices to date, is of great significance. In this regard, Seastone (42) has projected increasing family and per capita income and, in effect, continued prosperity in Alberta.

Generally, this will be good for urban areas but the rural income situation needs surveillance, respecting university student generation, as discovered in this study.

Regarding metropolitan Edmonton itself, Hanson (27) predicts a favourable income situation to 1981.

In view of these predictions, continuing prosperity in Edmonton appears indicated such that the projected university student generation appears reasonable.

2.4. Population Projections Concluded and Summary for Transportation Planning

An examination of TABLE II-23 in relation to the city's current detailed population projection (60) for 1981 shows that the estimated age 15 to 24 proportion of 19.49% is 0.65%, or approximately 460 university students, high on comparable Metro populations. Additionally, the Metropolitan Edmonton population projection (60) in relation to census division 11 of TABLE II-17 may be 25,000 people, or approximately 800 students, high. Thus TABLE II-23, showing 22,141 full-time, day, winter session students (projected to 1981/1982), is 1,260 students high upon the Metro and Provincial resolution of projected populations to 1981/1982. Oddly enough, however, as TABLE II-25 shows, this number of students is very close to the number required to recognize the contribution of 2,301 projected part-time day, winter session students to the transportation problem.

In order that the projected 1981/1982 resident Edmonton students appear in a form most useful to transportation planning, the information from TABLE II-23 was resummarized on a METS zone basis shown in TABLE

TABLE II-25

THE UNIVERSITY OF ALBERTA HISTORIC NON-ALBERTAN ENROLMENT* AND PART-TIME DAY WINTER SESSION ENROLMENT***

Year	Other Canadian	Foreign	Total Students
1958/59	399	109	508
1959/60	391	118	509
1960/61	439	183	622
1961/62	427	181	608
1962/63	447	186	633
1963/64	513	229	742
1964/65	583	333	916
1965/66	654	440	1,094
1966/67	700	660	1,360
1967/68	804	595	1,399
1968/69	905	939	1,844
1969/70	984	863	1,847
1970/71	1,123	873	1,996
1971/72	1,076	976	2,052
1972/73			

PART-TIME DAY WINTER SESSION ENROLMENT**

Year	Students (actual)	Year	Students (projected)	Full-Time Equivalent Students
1964/65	618	1971/72	1,257	
1965/66	740	1972/73	1,362	
1966/67	884	1973/74	1,466	
1967/68	926	1974/75	1,571	
1969/70	1,002	1975/76	1,675	
1970/71	1,183	1976/77	1,779	
		1977/78	1,884	
		1978/79	1,988	
		1979/80	2,092	ESTIMATE:
		1980/81	2,197	50% of 2,301
		1981/82	2,301	or approx.
		1982/83	2,406	1,200

* Projections not shown because of uncertainties as to a basis for projections.

** Least square error projection.

*** Source: Ref. 36.

II-26 (Ref. FIGURES 2.5, 2.6, and 2.7). This was done simply by distributing projected students per census tract into the makeup METS zones, in relation to the equivalent METS zone student inputs to the projections, duly noting the type of student generation cycle growth indicated as a general guide. Next, the 4,059 non-resident Edmonton students were distributed by computer to all METS zones using a linear, least squares projection method based on their 1966/1967, 1967/1968 and 1970/1971 METS zone residential living patterns. The projected faculty and staff of TABLE II-26 were distributed to METS zones on a similar basis subject to a special new neighbourhood treatment described towards the end of this section of this report. Thus, in summary, TABLE II-26 sets out in a transportation planning form, 22,141 full-time, plus full-time equivalent of part-time, day, winter session students, and 4,059 non-resident Edmonton students, to yield the total planning figure of 26,200 students. More precisely, this is the 25,000 students of Academic Plan Number Nine (49), plus 1,200 full-time equivalent students representing the projected part-time, daytime students who also contribute to the university transportation requirements. Regarding the student METS zone distribution method used, the fact that no non-resident students have been assigned to the six new city neighbourhoods is considered a negligible error, as typically, the vast majority of these students live close in to U. of A.

At this point in the summary a brief discussion of the future post-secondary educational enrolment situation in Edmonton will have merit. In short, when the 26,451 provincial University of Alberta students (Ref. TABLE II-20) are combined with an estimated minimum of 2,500 other Canadian plus foreign students (Ref. TABLE II-25), it yields

TABLE II-26

SUMMARY OF UNIVERSITY OF ALBERTA STUDENTS AND STAFF 1981/1982 FOR TRANSPORTATION PLANNING

METS ZONE	STUDENTS		STAFF	METS ZONE	STUDENTS		STAFF
	RESIDENT EDMONTON	NON RESIDENTS			RESIDENT EDMONTON	NON RESIDENTS	
0010	20	7	20	0870	190	5	67
20	12	–	–	0880	130	7	54
30	3	–	–	0910	100	9	24
40	15	5	10	920	149	3	15
50	293	23	66	930	322	6	84
60	74	8	4	940	355	4	76
70	100	21	18	950	0	0	0
0110	54	4	5	960	7	–	4
120	72	7	10	1010	451	6	86
140	32	6	4	1020	258	1	22
150	44	4	3	1031	136	1	87
0210	459	5	83	1032	91	1	43
220	37	7	18	1041	131	1	15
230	461	5	95	1042	88	1	7
240	42	–	5	1110	53	1	24
250	34	3	8	1120	86	1	33
260	368	3	54	1130	25	2	6
0310	161	16	40	1140	13	1	18
320	390	4	131	1150	70	2	18
330	312	4	97	1160	68	2	56
0340	164	4	34	1170	68	1	4
0410	112	8	40	1310	167	6	35
430	134	6	6	1320	105	4	23
440	191	6	22	1330	106	3	19
0510	50	1	30	1340	150	3	76
520	35	5	3	1410	129	4	13
540	55	4	25	1421	112	5	37
550	34	1	21	1431	114	5	38
560	39	6	10	1440	41	5	12
0710	29	3	16	1520	35	2	9
720	378	6	35	1540	36	2	6
730	415	4	56	1550	0	0	6
0810	85	6	31	1610	14	3	3
820	80	6	9	1620	64	4	6
830	70	8	13	1630	97	2	24
840	4	4	–				
860	301	16	60				

TABLE II-26 - (Cont'd.)

METS ZONE	STUDENTS RESIDENT EDMONTON	STUDENTS NON RESIDENTS	STAFF
1710	79	-	11
4133	32	-	-
1910	49	-	31
1920	76	-	18
1930	105	-	27
1940	105	5	10
1950	93	4	22
1960	120	-	27
4120	713	2	119
2010	834	190	330
2020	270	639	254
2110	541	95	216
2120	20	14	20
2130	91	9	31
2140	70	15	28
2210	663	1912	70
2220	120	68	122
2230	325	138	161
2250	324	6	75
2310	374	255	90
2320	285	43	118
2330	200	44	69
2340	226	53	43
2350	135	22	21
2360	89	9	24
2370	258	13	120
2410	116	5	87
2420	102	11	31
2430	142	6	32
2440	132	4	18
2450	41	3	5
2460	115	5	16
2470	138	5	76
2510	90	6	21
2520	126	9	36
2530	180	7	71
2540	82	6	41
2610	97	6	12
2620	111	9	22
2630	299	5	34
2640	290	9	54
2710	88	7	24
2720	234	12	120
2730	28	-	34
2810	5	1	2
2910	38	4	12
2920	9	4	5
2960	39	5	44
3010	146	20	94
3021	383	-	150
3022	174	-	277
3030	97	-	210
3040	95	-	276
3050	144	1	135
Castle Downs	152	-	279
West JP	339	-	149
Riverbend	1169	8	237
Kaskitayo	304	-	238
Millwoods	375	-	488
4250	469	1	257
Hermitage	226	-	214
OTHER COMMUTERS			
North	48	5	4
South	90	10	20
East	69	5	104
West	42	4	61
TOTAL PEOPLE	22141	4059	8179

28,951 potential University of Alberta students. Thus, with U. of A. taking only 25,000 full-time day, winter session students from the potentially available group, a considerable body of students is potentially available in 1981/1982 for Alberta colleges and technical schools, with no restraint to U. of A.'s academic plan.

More specifically, the Northern Alberta Institute of Technology (NAIT) enrolment was examined carefully with the following results. In essence, NAIT has grown to a 4,000 student enrolment level to 1971/1972 simultaneously with U. of A. growing to an 18,000 student enrolment level, with the former having quite insignificant impact upon the growth of the latter. A close examination of NAIT programs shows that only 25% of them are potentially competitive with U. of A. programs. When this fact is combined with the fact that NAIT enrolment is approximately 80% Albertan, it can be seen that, at their projected 1981/1982 level of 8,000, only 1,600 will be relevant to possible university enrolment (i.e. 8,000 x 25% x 80%). And, in actuality, as NAIT grew to 4,000 with virtually no impact on U. of A. it is reasonable to assume the potential effect above will be considerably less than the possible maximum of 1,600 students; very likely, it will be less than 800 students. This, of course, assumes that there will be no major change in the kinds of programs offered.

Grant MacEwan Community College enrolment (50) was given similar scrutiny to NAIT with the following results. It would appear at this early stage in the development of the college that only 20% to 25% of programs offered are in potential competition with U. of A. programs. At this point in time the enrolment at the two year old institution is

roughly 1,000 (1972/1973) with very little impact on U. of A. programs to date. As the enrolment projection of the college to 1981/1982 is 5,000, only 1,250 students at maximum would be relevant to U. of A. (5,000 x 25%), assuming no major change in the types of programs offered. Interestingly enough, APPENDIX I, showing enrolment of all colleges in Alberta, depicts Mount Royal College in Calgary at less than 2,500 enrolment. In view of the fact this college is very old and reputable and located in an urban area comparable to Edmonton, the unpublished Grant MacEwan Community College enrolment projection must immediately be suspect as high.

In conclusion, therefore, the university student enrolment projections of this chapter show sufficient latitude so as not to be adversely affected by other Edmonton post-secondary educational institutions to 1981/1982, notwithstanding the earlier assumption regarding Athabasca University.

The final item in the overall University of Alberta population projection for transportation planning was to determine the number of faculty and staff required and their neighbourhood distributions throughout the city.

First, from Academic Planning Report No. 9 (49) complete with addendums, a recent estimate of teaching faculty requirements was obtained. The estimate is, of course, based on a computer analysis matching weekly student hours of projected teaching workloads with teaching and support faculty required to conduct the work. The possibility of changing academic programs or other circumstances does exist, however, such that the staff estimate should be viewed simply as a

number with which to do transportation planning. Next, from a comparison of the projected academic staff requirements to the actual 1970/1971 comparable payroll record, the growth ratio was obtained which was used to scale up recorded 1970/1971 non-academic staff accordingly. Note that a probable over-estimate of the non-academic staff will be used to account for the transportation input of many campus visitors not otherwise accounted for. Summaries of the entire staff estimation details may be viewed in APPENDIX I.

The last step was to obtain the 1981/1982 city distributions of projected faculty and staff which was done as follows. First, in direct proportion to the projected population of the six new and planned (7, 8, 9, 39, 43, 66) city growth areas (Ref. FIGURE 2.12), in relation to the total city population (Ref. FIGURE 2.12), faculty and staff were assigned accordingly. This assignment was restrained to the extent of previous university experience on broad geographic choice of living area by staff. Thus, the appropriate total staff increment involved was redistributed favouring the south and west of the City of Edmonton. Next, the remainder of the staff (8,179 - 1,605 = 6,574) were then distributed proportionately amongst existing metro neighbourhoods and/or METS zones based on the experience of previous staff transportation studies (1, 2, 34). TABLE II-26 summarizes all staff according to the above assignment to METS zones.

This, therefore, concludes population forecasting for The University of Alberta to 1981/1982, performed for Transportation Planning purposes to follow. Please note that a possible liberal approach to the part-time student transportation contribution, and also to having no

basis to effect some economics of scale to non-academic staff, will be justified as the peak hour contribution of campus visitors to the transportation problem.

CHAPTER III

MODE SPLIT ANALYSES

3.1. General

This chapter of the report deals with an investigation into past and recent use of the various U. of A. transportation modes: bus, car, walk, etc., by students, faculty and staff. (Henceforth called students and staff unless otherwise noted.) The purpose of this element of the study is to develop a scientific explanation of mode choice conducive to then predicting such an element in the future.

This portion of the study is thus based on past university transportation studies being student questionnaire survey of 1965/1966, 1966/1967, 1967/1968 and 1970/1971 conducted at autumn registration each year; and staff transportation questionnaire surveys of 1965/1966, 1966/1967, 1970/1971 conducted in late autumn each year via paycheck mail out distribution. In these years the necessary transportation questions were asked and received (Ref. APPENDIX II), and made immediately useable via key punching and computer compilation of the appropriate data. Note that the Metropolitan Edmonton Transportation Zones (22) (METS zones) are used as the basis of geographic analysis and reporting in the Metropolitan Edmonton area (Ref. FIGURE 2.6).

3.2. Travel Time Zones and Mode Split

From the 1970/1971 student and staff transportation questionnaires (Ref. APPENDIX II) average weekday travel times to The University of Alberta from all METS zones were calculated. These times are for use of both the bus and car modes of travel and are interpreted as portal to portal travel times utilizing each mode. The times were summarized for the city by METS zones on TABLE III-1 as was the travel time ratio, which is defined as the quotient of public transit travel time (bus) over automobile travel time. The reader will note that there are a few zones in TABLE III-1 for which no travel times are given. This is caused by insufficient questionnaire response from a given METS zone to obtain a reliable average travel time value. In later analysis appropriate travel times were inferred from adjacent zones.

With regard to the quality of the travel times in question a comment is in order. First it would be appropriate to point out that the travel time responses represent a melding together of actual plus perceived home to work (residence to campus) travel times. This is so because users of all modes were asked to respond to both bus and car travel times even if one mode or the other were used only very infrequently. Perhaps it is prudent to point out here that in many respects perceived travel times have as much to do as actual travel times in influencing people's choice of travel modes where a choice exists. Nevertheless the comparison of the overall average travel time responses of students and staff indicates close agreement as follows. For public transit (bus) the average portal to portal travel time for students was 44.3 minutes compared to staff at 45.6 minutes. Whereas car travel times averaged 19.1 minutes for students and 16.6 minutes for staff,

TABLE III-1

THE UNIVERSITY OF ALBERTA STUDENT AND STAFF 1970/1971 HOME TO WORK TRAVEL TIMES (in minutes) AND TRAVEL TIME RATIOS BY METS ZONES

Mets Zone	Bus Travel Time	Car Travel Time	Travel Time Ratio	Mets Zone	Bus Travel Time	Car Travel Time	Travel Time Ratio
0010		16.2-		0860	44.5	15.1	2.95
20		14.2		870	33.1	15.3	2.16
30		15.0		880	36.3	16.5-	2.20
40	27.9-	13.9-	2.01	0910	53.2-	18.8	2.83
50	20.9	12.8-	1.63	920	54.5-	19.9	2.74
60	20.5	15.0-	1.37	930	65.7	20.2	3.25
70	22.0	14.8-	1.48	940	68.2-	20.7	3.29
0110	42.9	21.9	1.96	950			
120	49.5-	21.6	2.29	960	75.6	19.3-	3.92
130				1010	64.3	21.6-	2.98
140	46.7	20.6	2.27	1020	61.9	19.7	3.14
150	38.4-	20.0	1.92	1030	69.2-	18.6-	3.72
0210	45.1-	19.3-	2.34		72.2-	17.6-	4.10-
220	49.0-	23.4-	2.09	1040	63.1-	18.9-	3.34-
230	52.3-	18.6	2.81		73.4-	19.3-	3.80
240	57.1-	21.4	2.67	1110	54.7	21.0-	2.60
250	61.6	22.0	2.80	1120	64.7	25.0	2.59
260	56.4	25.0-	2.26	1130	45.4-	21.4-	2.12
0310	27.1	13.9	1.95	1140	49.7	24.5	2.03
320	37.4-	13.6	2.75	1150	61.0	22.0	2.77
330	40.9	14.1-	2.90	1160	62.1-	17.8	3.49
340	48.5	13.8	3.51	1170	60.6	19.6	3.09
0410	49.8-	22.3	2.23	1180	76.7	22.5	3.41
420				1190	60.0	--	--
430	62.3	28.5	2.19	1210	65.0	26.7	2.43
440	62.7	28.4-	2.21	1220	45.0	20.0	2.25
0510	54.7	24.4	2.24	1230	--	--	--
520	57.9-	26.8	2.16	1310	72.5	27.1	2.68
530				1320	67.4	25.6	2.63
540	60.0-	31.0	1.94	1330	71.0-	30.3	2.34
550	63.4-	30.0	2.11	1340	70.3	30.1	2.34
560	63.0	27.2-	2.32	1410	68.7-	30.9	2.22
0710	65.1	20.2-	3.22	1421	72.5-	33.2	2.18
0720	57.2	17.6	3.25	1431	74.3-	32.4	2.29
730	49.1-	16.7	2.94	1440	70.1	35.8	1.96
0810	63.3	19.6-	3.23	1510			
820	57.4-	18.8	3.05	1520	70.4	33.8	2.08
830	46.7	17.8	2.62	1530			
840	47.8	18.2	2.63	1540	64.7-	32.5	1.99
				1550	75.0	30.0	2.50

TABLE III-1 - (Cont'd.)

Mets Zone	Bus Travel Time	Car Travel Time	Travel Time Ratio	Mets Zone	Bus Travel Time	Car Travel Time	Travel Time Ratio
1610	70.0	31.3	2.24	2510	56.3	21.2	2.66
1620	68.2-	32.8-	2.08	2520	42.1	21.4	1.97
1630	66.6-	33.4	1.99	2530	42.2-	21.1-	2.00
1710	66.2	32.0	2.07	2540	36.1	19.8-	1.82
1720				2550			
4133	69.2	30.1	2.30	2610	47.5-	23.6-	2.01
1910	81.4	34.1	2.38	620	43.3-	21.1	2.05
1920	77.5	33.0	2.35	630	65.1-	26.9	2.42
1930	77.6	33.7	2.30	2640	59.8-	25.5-	2.35
1740	81.1	35.8	2.27	2710	57.9	25.3	2.29
1450	76.8	34.0-	2.26	2720	51.3	23.4-	2.19
1960				2730	45.2	22.1-	2.05
				2810	43.3	20.0	2.17
4120	66.2	29.8	2.22	2820		25.0	
				2910	47.5-	18.7-	2.54-
2010	19.4	10.2-	1.90	920	43.8-	18.0	2.43
2020	12.1	6.9-	1.75	930		20.0	
2110	27.7	14.9-	1.86	940		25.0	
2120	39.8	14.7	2.71	950	50.0	18.3	2.73
2130	46.2-	19.3-	2.39	2960	46.6	17.2-	2.71
2140	30.5-	18.0-	1.69	3010	28.0	14.5-	1.93
*2210	12.1	6.9	1.75	20	32.3	15.2-	2.13
2220	13.9	6.3-	2.21		40.1-	18.0-	2.23
2230	20.5	9.4-	2.18	30	30.7-	14.6-	2.10
2240				40	44.5-	18.0	2.47
2250	27.2	13.7	1.99	3050	38.9	18.2-	2.14
2310	20.4	10.2-	2.00	3110	45.0	27.5	1.64
2320	25.2	12.8-	1.97	120	48.5	18.5	2.62
2330	23.8	12.8-	1.86	130	71.7	19.3	3.72
2340	23.9	14.0-	1.71	140	53.3	16.7	3.19
2350	39.7-	16.6	2.39	150			
2360	45.5	17.2	2.65	3160			
2370	29.6-	15.6-	1.90				
2410	29.4-	16.5-	1.78	4250	61.5	30.6-	2.01
420	31.9	18.2-	1.75				
430	37.8-	20.4	1.85				
440	46.2	22.1	2.09				
450	42.4	18.3-	2.32				
460	49.7	20.6	2.41				
2470	44.1	19.1	2.31				

- Exceptionally good agreement between student and staff travel time estimates.

* The U of A campus METS zone.

based on over 20,000 transportation questionnaire responses. However in the case of automobile travel times we can observe that generally faculty and staff live in the various established neighbourhoods of Edmonton proper, with greatest numbers in the south and west even adjacent to the campus, whereas many students tend to live further out in all directions and commute longer distances to The University of Alberta. The comparison of student and staff average travel times for bus and car for all the METS zones of Metropolitan Edmonton proved that generally there was reasonable to good agreement amongst the several responses. Thus suffice to say at this point, student and staff travel times appear to be entirely suitable for campus transportation planning purposes. The data stability section (Ref. 3.6.2) of this chapter will develop this matter further.

Having obtained the necessary travel times as described above the next step in the analysis was to develop the 1970/1971 university, home to work travel time zones throughout the city upon which to base the first mode split analysis. The travel time zones are shown on FIGURES 3.1 and 3.2 along with the comparable 1966 information, and the summary of historic mode split on the 1970/1971 public transit travel time basis is shown in TABLES III-2 and III-3 for students and staff. Additionally the findings of Associated Engineering Services Ltd. (1) (note: name abbreviated to Associated) of 1966 on travel times are also included in APPENDIX II for the purpose of informative discussion to follow, as to the evolution of travel times and mode split from 1965/1966 to 1970/1971.

Regarding the student and staff mode splits (Ref. TABLES III-2 and III-3) performed on the basis of the 1970/1971 transit travel time

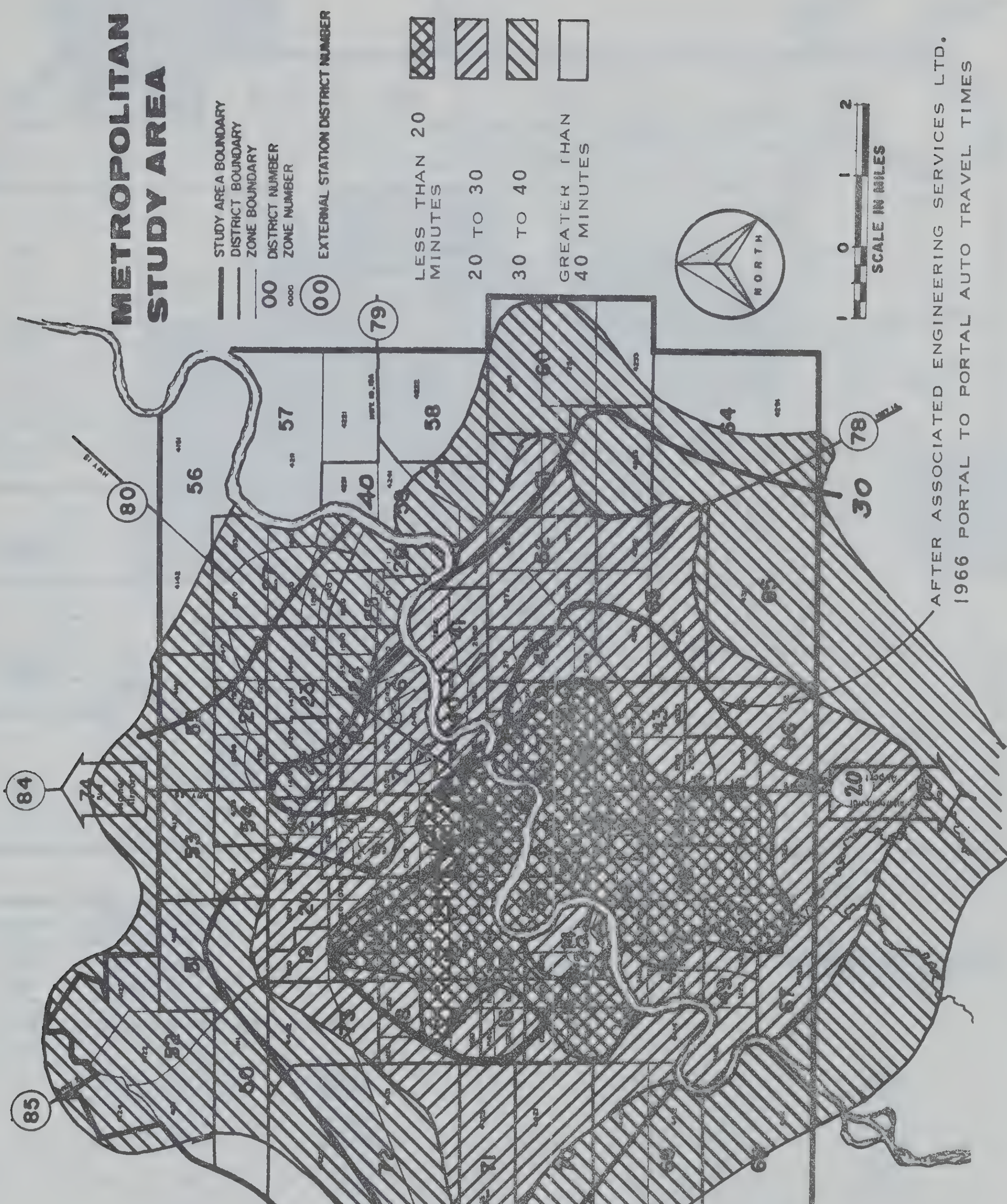
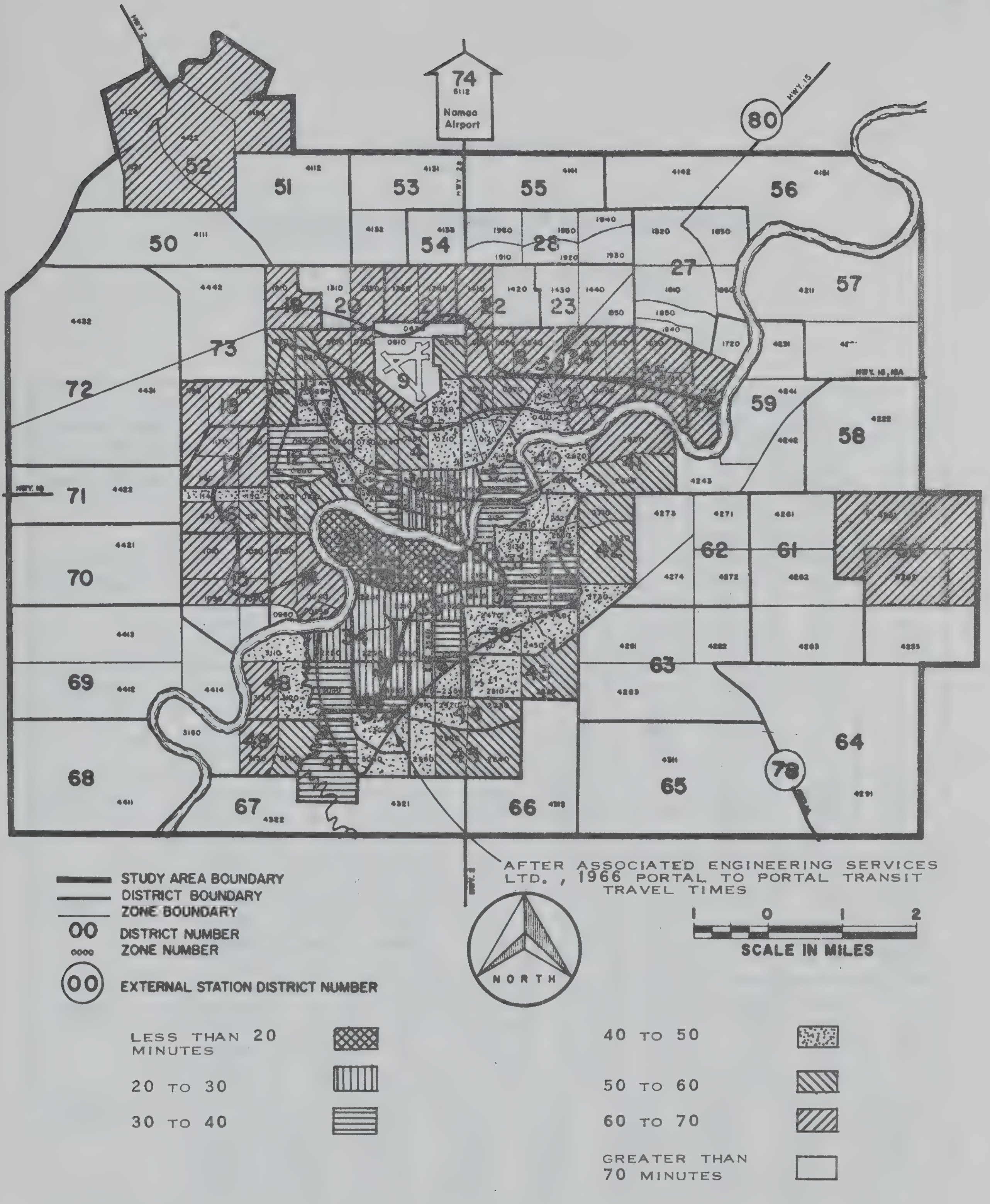


FIGURE 3.1. THE UNIVERSITY OF ALBERTA 1966 AND 1970/1971 PORTAL TO PORTAL AUTOMOBILE TRAVEL TIME ZONES



AFTER ASSOCIATED ENGINEERING SERVICES LTD., 1966 PORTAL TO PORTAL TRANSIT TRAVEL TIMES

FIGURE 3.2. THE UNIVERSITY OF ALBERTA 1966 AND 1970/1971 PORTAL TO PORTAL PUBLIC TRANSIT TRAVEL TIME ZONES

TABLE III-2

THE UNIVERSITY OF ALBERTA STUDENT MODE SPLITS
BY 1970/1971 PORTAL TO PORTAL
TRANSIT TRAVEL TIME ZONES

Travel Mode	Year	Residence to Campus Transit Travel Times (Minutes)							Total
		<20	20-30	30-40	40-50	50-60	60-70	>70	
Auto Driver	65/66	12.0%	36.4	47.8	50.3	48.0	49.2	61.0	32.0
	66/67	6.0	28.4	36.7	41.9	45.0	46.0	54.7	27.7
	67/68	6.5	24.0	36.4	40.0	42.3	43.9	52.5	27.1
	70/71	4.5	19.1	36.1	36.3	37.7	45.0	56.8	26.7
Car Pool	65/66	0.6	5.2	9.5	9.9	17.4	18.0	12.5	6.8
	66/67	1.1	6.2	7.9	8.7	11.5	12.0	6.6	6.1
	67/68	1.3	5.4	9.2	8.7	11.7	13.2	8.7	6.6
	70/71	1.1	4.2	8.0	7.9	9.3	10.6	9.1	5.9
Drop Off	65/66	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	66/67	1.3	5.7	7.2	7.2	9.1	8.6	7.4	5.3
	67/68	1.4	5.7	6.7	7.7	8.5	8.8	9.8	5.5
	70/71	1.1	3.6	5.4	5.3	5.5	7.9	8.7	4.4
Bus	65/66	4.4	27.9	39.0	36.2	31.8	30.6	26.1	20.9
	66/67	3.6	32.6	45.4	40.3	32.7	32.5	29.2	24.6
	67/68	4.2	37.8	45.7	41.9	36.1	32.7	26.3	27.3
	70/71	4.5	40.9	46.0	47.9	45.0	34.9	23.6	30.9
Walk	65/66	81.7	29.1	2.5	2.3	1.8	1.2	--	39.1
	66/67	87.3	25.7	2.3	1.7	1.4	0.6	1.6	35.6
	67/68	86.0	26.2	1.6	1.3	1.0	1.1	2.4	32.9
	70/71	87.4	29.0	2.3	1.1	1.2	0.7	0.1	30.4
Other	65/66	1.3	1.4	1.2	1.3	1.0	1.0	0.4	1.2
	66/67	0.7	1.4	0.5	0.2	0.3	0.3	0.5	0.7
	67/68	0.6	0.9	0.4	0.4	0.4	0.3	0.3	0.6
	70/71	1.4	3.2	2.2	1.5	1.3	0.9	0.1	1.7
Total	65/66	100	100	100	100	100	100	100	100
	66/67	100	100	100	100	100	100	100	100
	67/68	100	100	100	100	100	100	100	100
	70/71	100	100	100	100	100	100	100	100

TABLE III-3

THE UNIVERSITY OF ALBERTA STAFF MODE SPLITS
BY 1970/1971 PORTAL TO PORTAL
TRANSIT TRAVEL TIME ZONES

Travel Mode	Year	Residence to Campus Travel Times (Minutes)							Total
		<20	20-30	30-40	40-50	50-60	60-70	>70	
Auto Driver	65/06	33.7%	73.6	72.9	72.1	76.3	75.9	75.8	65.2
	66/67	39.0	65.2	71.6	65.6	68.8	79.0	81.6	63.7
	70/71	20.4	48.5	64.1	60.9	63.2	72.1	81.7	54.7
Car	65/66	0.9	3.2	1.0	2.4	2.3	4.0	3.2	2.4
	66/67	3.2	5.8	4.9	9.8	6.0	6.3	8.2	6.0
	70/71	2.3	5.1	10.0	10.7	9.6	9.4	7.1	7.5
Drop Off	65/66	3.0	4.9	8.2	9.2	9.3	7.9	8.1	6.3
	66/67	2.1	3.8	3.3	3.8	6.9	4.2	3.1	3.7
	70/71	3.4	7.9	5.8	6.5	6.1	5.1	3.5	5.9
Bus	65/66	2.4	11.2	17.4	16.3	12.1	12.2	12.9	10.9
	66/67	3.6	15.2	19.8	20.4	17.9	10.5	7.1	13.6
	70/71	2.9	20.3	17.4	20.2	20.7	12.8	7.1	15.3
Walk	65/66	58.1	6.8	0	-	-	-	-	14.6
	66/67	50.8	8.7	0	0.2	0.4	0	0	12.3
	70/71	67.0	15.5	2.1	0.8	0.4	0.2	0	15.0
Other	65/66	1.9	0.3	0.5	-	-	-	-	0.6
	66/67	1.3	1.3	0.4	0.2	0	0	0	0.7
	70/71	4.0	2.7	0.6	0.9	0	0.4	0.6	1.6
Total	65/66	100	100	100	100	100	100	100	100
	66/67	100	100	100	100	100	100	100	100
	70/71	100	100	100	100	100	100	100	100

zones (Ref. FIGURE 3.2), the following observations can be made. For students and staff three of the six modes shown being auto driver, bus, and walk are the modes used most predominantly at all times in the past. Car pool which represents higher utilization of campus bound vehicles, passenger drop-off, and the mode other, being bicycle, hitchhiking, etc., are in fact the minor modes in use. Passenger drop-off is a mode which relates to vehicles often bound for downtown or elsewhere dropping off people while passing the university area.

With regard to student mode split, TABLE III-2 shows that for a travel time of less than 20 minutes walk has increased from 81.7% in 1965/1966 to 87.4% in 1970/1971 which, in keeping with the higher enrolment (Ref. TABLE II-1), has greatly increased the density of student walkers generally within one and one half miles of The University of Alberta. This increase in walk has occurred commensurate with a decreased percentage share use of the auto driver mode which dropped from 12.0% in 1965/1966 to 4.5% in 1970/1971 while bus use stayed almost constant. Upon further examination of TABLE III-2 for travel time zones at increasing travel time or distance from The University of Alberta, it is evident that the major change in student mode use has been a shift from the auto driver mode to bus use from 1965/1966 to 1970/1971. This increase in bus use has been extensive and important to students and The University of Alberta. Still use of auto driver is greater for transit travel times of 60 minutes or more, at which time public transit use by students incurs a sharp drop. These areas of the City of Edmonton are shown on FIGURE 3.2. In the case of both the bus and car modes absolute numbers of student users has increased due to increased university enrolment. Concluding student mode use observations the percentage

share of car pooling has declined slightly as has passenger drop-off while the use of the travel mode other has increased.

Turning now to TABLE III-3 showing staff travel mode use, a similar pattern to student mode use has occurred in the less than 20 minute travel time zone as the auto driver mode use has declined from 33.7% in 1965/1966, to 20.4% in 1970/1971, while walk mode use has gone up from 58.1% in 1965/1966 to 67.0% in 1970/1971, with bus use remaining relatively stable. For travel times zones at increasing distance from The University of Alberta staff percentage use of the auto driver mode has declined while use of bus has generally increased. As for students, staff bus use falls off sharply for a portal to portal transit travel times exceeding 60 minutes. These areas are shown on FIGURE 3.2. In the greater than 70 minute travel time zone auto driver percentage use has increased in five years. Staff use of car pool, unlike student use, has increased dramatically from 2.4% to 7.5% from 1965/1966 to 1970/1971, whereas passenger drop-off has declined (Ref. TABLE III-3). Also the travel time or distance range of use of the mode other has increased in keeping with an overall percentage share increase of 1% in five years. In summary recent student and staff changes in mode use, which will subsequently be related to the variables parking supply and bus service, are of great significance in the appreciation of mode use trends relevant to any predictions. Because university student enrolment and staff have greatly increased from 1965/1966 to 1970/1971, declines in percentage use of a given mode does not necessarily result in lesser absolute numbers of users.

Commensurate with observed changes in travel mode use there has been significant change in travel times to The University of Alberta in five years. To facilitate observations in this regard it was first necessary to equate the Associated (1) travel time basis with the basis of the 1970/1971 portal to portal travel time observations for an equitable comparison. In essence, to Associated's (1) auto travel times must be added walking, garage opening, walk to campus building, etc., time to bring it up to a portal to portal travel time, as the time they measured was time recorded driving away from campus in all directions in peak hours only. This time has been estimated at roughly four minutes and/or one third mile assuming this kind of time is worth five miles per hour. Thus when Associated's auto travel time rings (Ref. APPENDIX II) are all moved one third mile closer into University of Alberta they can then be compared to the equivalent 1970/1971 auto travel time rings as shown on FIGURE III-1. Such a comparison immediately shows that in general auto travel time has worsened in five years which is due to increased vehicular densities and traffic delays in Edmonton, more pedestrians, etc. Also FIGURE III-1 shows however, that the advent of the new Quesnell Bridge in west Edmonton represents an exception to a worsening travel time situation, as the 20 minute auto travel ring has been extended out further into southwest Edmonton. Oddly enough auto travel time to The University of Alberta via the Central Business District has shown slight improvement in five years possibly due to better roadways and signalization, and some decentralization or staggering of home to work auto congestion from this area.

Regarding public transit (bus) travel times Associated (1) used published transit schedule times from all city points to The University of Alberta, plus a flat 5 minutes where transfer was necessary. Thus to bring their time up to a portal to portal travel time it is necessary to add time for walking to and from bus stops, and waiting for the bus time. This time has been estimated at roughly 9 minutes on the average and/or three quarters of a mile assuming this kind of time is worth 5 miles per hour. Thus when Associated's transit travel time rings (Ref. APPENDIX II) are all moved three quarters of a mile closer in to The University of Alberta, generally along bus route corridors of 1965/1966, they can be compared on an equal footing with the 1970/1971 transit travel times (Ref. FIGURE 3.2) to observe changes. In effect such a comparison shows, as for auto, that portal to portal transit travel times have worsened considerably from 1965/1966 to 1970/1971, again due to increased peak hour vehicular densities, delays, and increased walking to stop distances. Also FIGURE 3.2 shows that the 20 minute 1970/1971 portal to portal transit travel time ring is confined exclusively to the south side of Edmonton, and that as of 1970/1971 (prior to the new Quesnell bus U4 (11)) the Quesnell Bridge had not improved on travel time to west Edmonton. It can be observed in general that 1970/1971 transit travel times further from The University of Alberta are significantly greater than in 1965/1966 most noticeably in northeast Edmonton. In conclusion it is evident throughout this travel time comparison that the 1970/1971 transportation questionnaire responses of over 20,000 university students and staff provide far greater and better travel time details than previously available; thus facilitating excellent insight into the problems associated with current

portal to portal bus and car travel times in the City of Edmonton. The observed changes in travel times and mode split recorded over five years will be of benefit in predicting any future transportation situation.

3.3. Travel Time Ratio

University travel mode split done on the previous basis is useful in that it provides an overview of absolute outlays of portal to portal bus and car travel times in the Metropolitan Edmonton area. Additionally it presents a clear view of trends in mode use in relation to travel time changes.

For the more rigorous demands of a prediction model, however, it is necessary to develop reproducible mode split relationships usually done graphically, and thus travel time ratio was first tried (29, 30). As mentioned in connection with the travel time ratios presented in TABLE III-1, it is derived as the quotient of bus travel time over car travel time, and as such recognizes that the ten minutes between 10 and 20 minutes travel time outlay (for example) carries a higher utility than the 10 minutes between, say 50 and 60 minutes travel time outlay (29). This is facilitated by a direct comparison of travel time ratios and not travel time of one mode isolated from that of another available from a given origin zone.

To try the travel time ratio method of mode split determinations on the university transportation situation first the travel time ratios of TABLE III-1 were summarized as shown on FIGURE 3.3 for all METS zones in the city. Additionally the two major satellite communities of St. Albert and Sherwood Park (Ref. FIGURE 2.8) were included, thus making it a Metropolitan Edmonton study in a limited sense. Then on the basis of

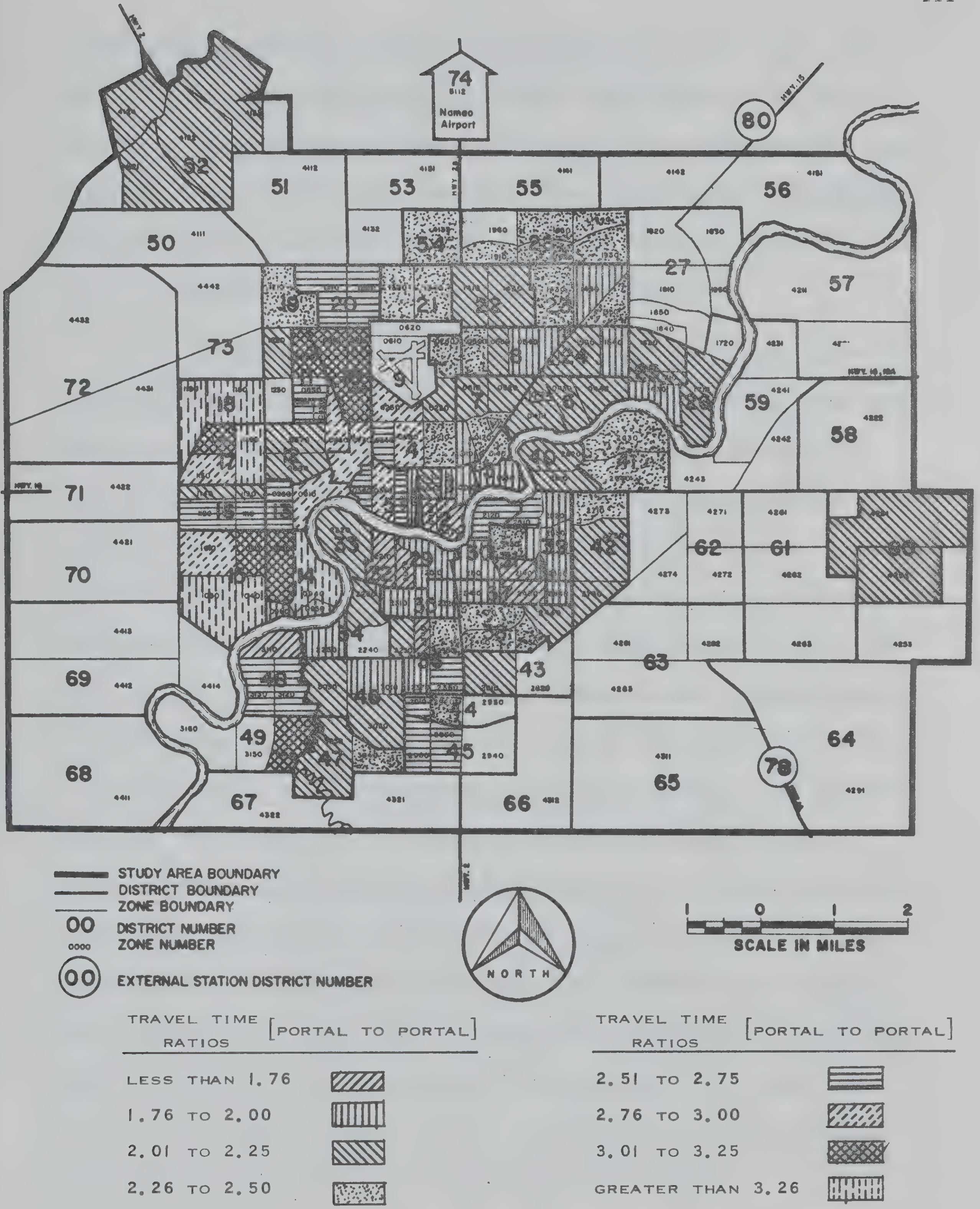
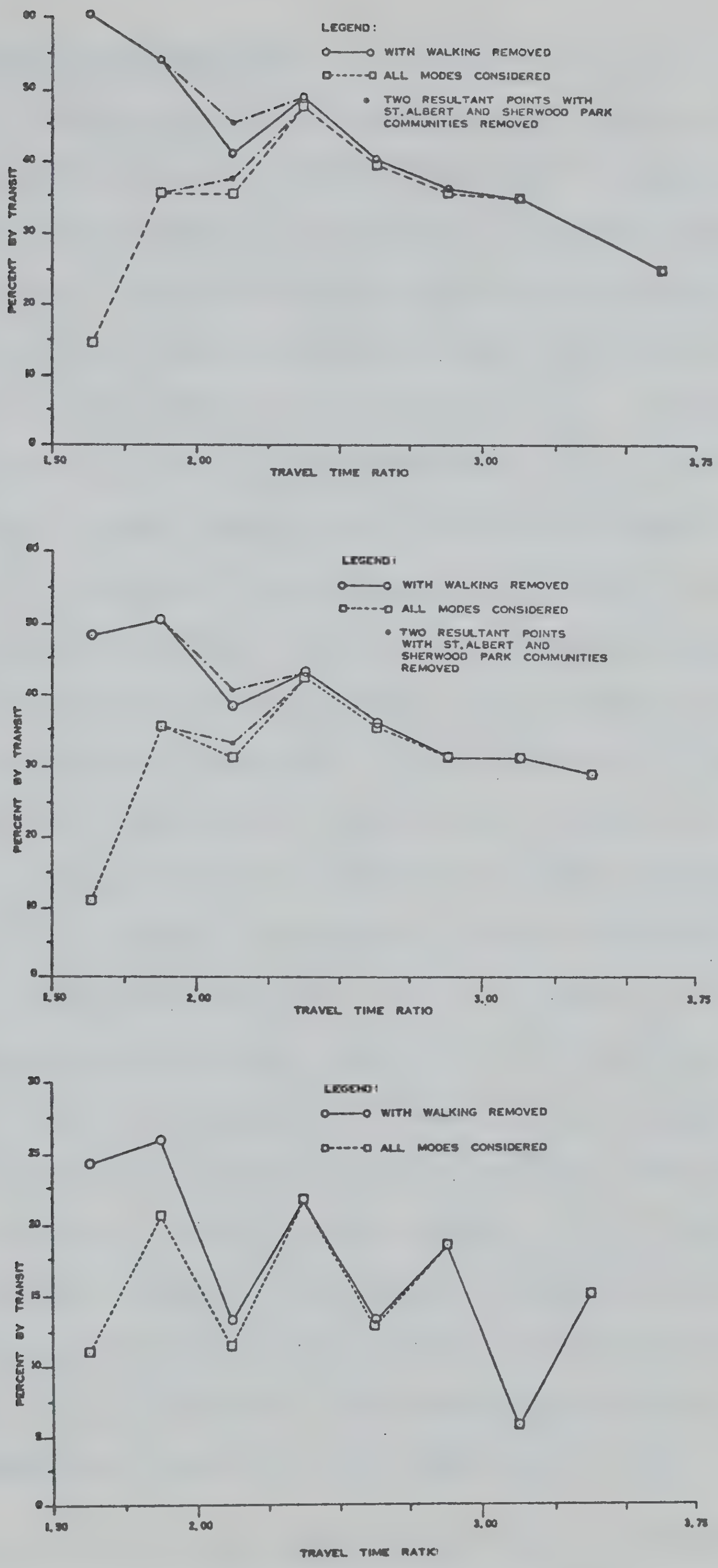


FIGURE 3.3. THE UNIVERSITY OF ALBERTA 1970/1971 PORTAL TO PORTAL TRAVEL TIME RATIO ZONES

a summary of the METS zones falling into each travel time ratio zone, a mode split take-off from university origin - destination transportation studies was performed for students, in 1970/1971 and 1967/1968 and staff 1970/1971. And finally on the basis of this form of mode split determination the three graphs (Ref. FIGURE 3.4) which follow were prepared to see if a reliable modal split relationship existed.

Upon viewing the graphical results several key points in the research immediately became evident. First although the travel time ratio method works well in the case of the student mode split (percent by transit) in 1967/1968 and 1970/1971, it is evident that the curves are significantly different from those associated with many central business district studies. This point immediately led to the realization that subsequent work must of necessity more fully recognize three (bus, car, walk) and not the usual two (bus and car) travel modes. Secondly upon due examination of the travel time ratio curves for staff, 1970/1971 it is evident that no good reproducible relationship exists. This appears to be due to the presence of a third major mode (walking), and the equality of the utility of travel time for walk, car and bus due to the closeness of substantial staff neighbourhoods to the campus. In short one can walk to campus from Windsor Park (Ref. FIGURE 3.5) or bus to campus from the 105 Street and 97 Avenue, north side high-rise apartment area, as quickly or more quickly than one can drive a car, park, and walk to work. This situation which is very healthy in many respects, unfortunately doesn't suit the travel time ratio method.

The third and concluding point, therefore is that in lieu of the points above it appears that it is not worthwhile to pursue the travel time ratio method any further.



Students
1970/1971

Students
1967/1968

Staff
1970/1971

FIGURE 3.4. THE UNIVERSITY OF ALBERTA STUDENT AND STAFF TRAVEL TIME RATIO MODE SPLITS

3.4. University Walking Study

As a result of research findings in the development of the travel time ratio curves, it became evident that the walking mode would have to be handled comparable to car and bus investigations complete with travel times. As such and because walk travel times had never been recorded, a walking study was designed as shown on FIGURE 3.5, after due examination of major METS zone origins of the mode. Further subject walking study was performed by the researcher August 6, 1972 by walking at a comparable speed to those younger individuals along the route (estimated at 3.0 m.p.h.) keeping generally to sidewalks, avoiding jay-walking, and obeying traffic signals. To a reasonable degree, the slightly slower pace of walking used was made to simulate university winter session walking conditions. The two exceptions to legal walking on sidewalks were, that at the northwest end of the High Level Bridge a short-cut was taken across the open field as students and staff do walk. Similarly at the south end of the bridge the short-cut across the tracks by trail up to 90 Avenue was used. Also in the area of The University of Alberta housing demolition a short-cut across a temporary parking lot to 112 Street and 89 Avenue was taken. A major assumption to the walking study was that all north side walkers gain access to The University of Alberta via the High Level Bridge. By way of many years of observations this assumption would appear to be quite a safe assumption as the vast majority of north side Edmonton, campus bound walkers do in fact use the High Level Bridge, which eliminates the need to climb Saskatchewan River valley hills (i.e. saves travel time).

As the various walks progressed the time at each corner of the route was duly recorded so that travel times to all relevant METS zones

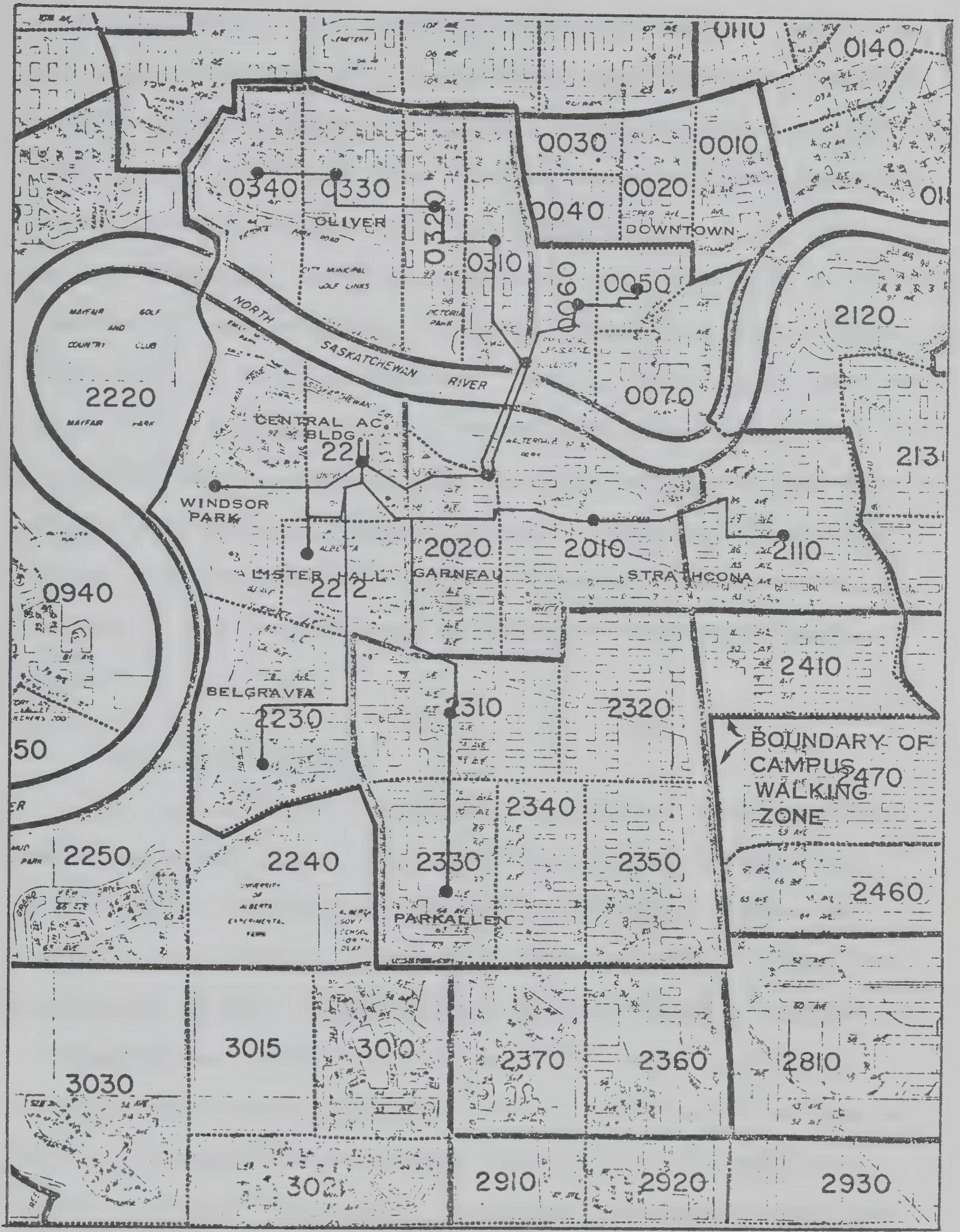


FIGURE 3.5. THE UNIVERSITY OF ALBERTA CAMPUS WALKING ZONE AND WALKING STUDY

could be calculated. The assumption was made that walking travel times should be reckoned from METS zone centroids (assuming uniform geographic distribution of university populations), and all times were measured to the second floor Central Academic Building elevators. The last detail necessary to the study to in fact bring walking times up to a portal to portal walking time, was to add appropriate time for a person to travel from his door down and out of a building to the street where the walking study times have been measured from. This additional time was measured as one minute fifteen seconds for high-rise apartment areas, forty-five seconds for walk-up apartment areas and thirty seconds for predominantly single family dwelling type neighbourhoods. Observed and calculated walking times are recorded on TABLE III-4, note that some rounding up and down of times was performed in keeping with the desired degree of accuracy.

3.5. Travel Time Difference

With the research experience gained from the travel time ratio method and having supplemented travel time data with the necessary campus oriented walking times, it was then feasible to proceed to explore the merits of the Travel Time Difference method for analytical mode split presentation. In this case portal to portal travel time differences were taken as the difference of bus minus car, and walk minus car travel time, thus having portal to portal car travel time as the unit of common time determination amongst the three major modes. TABLES III-4 and III-5 summarize walking-car, and bus-car travel time differences which cover all city METS zones (plus St. Albert and Sherwood Park) in the latter case, but only METS zones (Ref. FIGURE 2.6)

TABLE III-4

THE UNIVERSITY OF ALBERTA STUDENT AND STAFF 1970/1971 WALK MINUS CAR PORTAL TO PORTAL TRAVEL TIME DIFFERENCES (in minutes) BY METS ZONE

METS ZONE	WALK TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE
0050	32	13	19
0060	26	15	11
0070	34	15	19
0310	28	14	14
0320	35	14	21
0330	44	14	(30)
0340	49	14	(35)
2010	20	10	(10)
2020	15	7	8
2110	37	15	22
2210	11	7	4
2220	14	6	8
2230	30	9	21
2310	23	10	13
2320	33	13	[20]
2330	37	13	24
2340	44	14	[30]
2350	49	17	32
2410	44	16	28

( ) means to be considered with preceding 5 minute interval. *

[ ] means not to be considered with preceding 5 minute interval. *

* Results from an examination of walking times to the seconds level of time detail.

TABLE III-5

THE UNIVERSITY OF ALBERTA STUDENT AND STAFF 1970/1971 BUS MINUS CAR PORTAL TO PORTAL TRAVEL TIME DIFFERENCES (in minutes) BY METS ZONES

METS ZONE	BUS TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE
0010			
0020			
0030			
0040	27.9	13.9	14.0
0050	20.9	12.8	8.1
0060	20.5	15.0	5.5
0070	22.0	14.8	7.2
0110	42.9	21.9	21.0
0120	49.5	21.6	27.9
0130			
0140	46.7	20.6	26.1
0150	38.4	20.0	18.4
0210	45.1	19.3	25.8
220	49.0	23.4	25.6
230	52.3	18.6	33.7
240	57.1	21.4	35.7
250	61.6	22.0	39.6
260	56.4	25.0	31.4
0310	27.1	13.9	13.2
320	37.4	13.6	23.8
330	40.9	14.1	26.8
340	48.5	13.8	34.7
0410	49.8	22.3	27.5
420			
430	62.3	28.5	33.8
440	62.7	28.4	34.3
0510	54.7	24.4	30.3
520	57.9	26.8	31.1
530			
540	60.0	31.0	29.0
550	63.4	30.0	33.4
560	63.0	27.2	35.8
0710	65.1	20.2	44.9
720	57.2	17.6	39.6
730	49.1	16.7	32.4
0810	63.3	19.6	43.7
820	57.4	18.8	38.6
830	46.7	17.8	28.9
840	47.8	18.2	29.6
850			
0860	44.5	15.1	29.4
870	33.1	15.3	17.8
880	36.3	16.5	19.8
0910	53.2	18.8	34.4
920	54.5	19.9	34.6
930	65.7	20.2	45.5
940	68.2	20.7	47.5
950			
960	75.6	19.3	56.3
1010	64.3	21.6	42.7
1020	61.9	19.7	42.2
1031	69.2	18.6	50.6
1032	72.2	17.6	54.6
1041	63.1	18.9	44.2
1042	73.4	19.3	54.1
1110	54.7	21.0	33.7
1120	64.7	25.0	39.7
1130	45.4	21.4	24.0
1140	49.7	24.5	25.2
1150	61.0	22.0	39.0
1160	62.1	17.8	44.3
1170	60.6	19.6	41.0
1180	76.7	22.5	54.2
1210	65.0	26.7	38.3
1220	45.0	20.0	25.0
1310	72.5	27.1	45.4
1320	67.4	25.6	41.8
1330	71.0	30.3	40.7
1340	70.3	30.1	40.2
1410	68.7	30.9	37.8
1421	72.5	33.2	39.3
1431	74.3	32.4	41.9
1440	70.1	35.8	34.3

TABLE III-5 - (Cont'd.)

METS ZONE	BUS TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE	METS ZONE	BUS TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE
1510				2430	37.8	20.4	17.4
1520	70.4	33.8	36.6	2440	46.2	22.1	24.1
1530				2450	42.4	18.3	24.1
1540	64.7	32.5	32.2	2460	49.7	20.6	29.1
1550	75.0	30.0	45.0	2470	44.1	19.1	25.0
1610	70.0	31.3	38.7	2510	56.3	21.2	35.1
1620	68.2	32.8	35.4	2520	42.1	21.4	20.7
1630	66.6	33.4	33.2	2530	42.2	21.1	21.1
1710	66.2	32.0	34.2	2540	36.1	19.8	16.3
1720				2610	47.5	23.6	23.9
4133	69.2	30.1	39.1	2620	43.3	21.1	22.2
1910	81.4	34.1	47.3	2630	65.1	26.9	38.2
1920	77.5	33.0	44.5	2640	59.8	25.5	34.3
930	77.6	33.7	43.9	2710	57.9	25.3	32.6
940	81.1	35.8	45.3	2720	51.3	23.4	27.9
1950	76.8	34.0	42.8	2730	45.2	22.1	23.1
1960				2810	43.3	20.0	23.3
4120	66.2	29.8	36.4	2820			
2010	19.4	10.2	9.2	2910	47.5	18.7	28.8
2020	12.1	6.9	5.2	2920	43.8	18.0	25.8
2110	27.7	14.9	12.8	2930			
2120	39.8	14.7	25.1	2940			
2130	46.2	19.3	26.9	2950	50.0	18.3	31.7
2140	30.5	18.0	12.5	2960	46.6	17.2	29.4
2210	12.1	6.9	5.2	3010	28.0	14.5	13.5
2220	13.9	6.3	7.6	3021	32.3	15.2	17.1
2230	20.5	9.4	11.1	3022	40.1	18.0	22.1
2240				3030	30.7	14.6	16.1
2250	27.2	13.7	13.5	3040	44.5	18.0	26.5
2310	20.4	10.2	10.2	3050	38.9	18.2	20.7
2320	25.2	12.8	12.4	3110	45.0	27.5	17.5
2330	23.8	12.8	11.0	3120	48.5	18.5	30.0
2340	23.9	14.0	9.9	3130	71.7	19.3	52.4
2350	39.7	16.6	23.1	3140	53.3	16.7	36.6
2360	45.5	17.2	28.3	3150			
2370	29.6	15.6	14.0	3160			
2410	29.4	16.5	12.9	4250	61.5	30.6	30.9
2420	31.9	18.2	13.7				

relevant to significant amounts of campus walking in the former case. As will be noted in TABLE III-5, occasional METS zones recorded an insufficient number of responses from students and staff surveyed to arrive at a travel time difference. Thus when necessary in the analysis the necessary travel time differences were inferred from appropriate adjacent METS zones.

Next on the basis of similar walk-car, and bus-car travel time differences, METS zones were grouped into categories as shown on FIGURE 3.6 and TABLE III-6. Then based on this summary of travel time difference zones, a mode split take-off from university origins destination transportation studies (1, 2, 34) was performed, for students in 1967/1968 and 1970/1971 and staff in 1966/1967 and 1970/1971.

These particular years were selected as they represent the years of most accurate and complete data available, to adequately show the required mode split relationships. Finally mode split take-offs were summarized and percentages of mode use were calculated, for the purpose of plotting graphical travel time difference mode split relationships (Ref. APPENDIX II).

Regarding the bus minus car mode split take-offs, the less than ten minute travel time difference zones were not given mode split values, as the relevant METS zones are all heavily walk oriented, thus yielding misleading bus minus car travel time mode splits. Moving outward from the campus the 10 to 15 minute bus minus car, travel time difference zone, had sufficient numbers of METS zones falling outside the campus walking zone, to use in obtaining the true bus-car mode split. These METS zones are indicated on TABLE III-6.

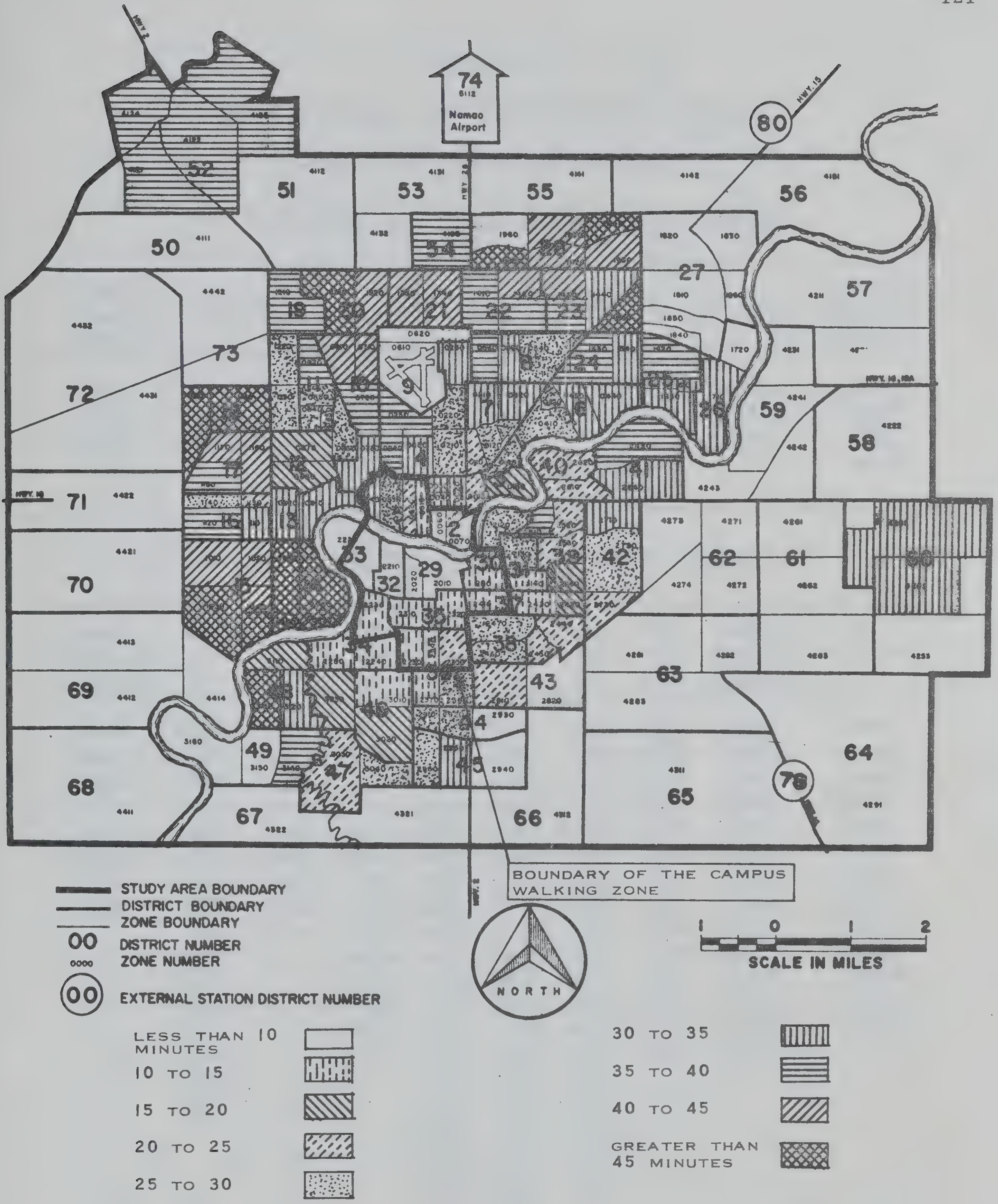


FIGURE 3.6. THE UNIVERSITY OF ALBERTA 1970/1971 BUS MINUS CAR PORTAL TO PORTAL TRAVEL TIME DIFFERENCE ZONES

TABLE III-6

SUMMARY OF METS ZONES BY 1970/1971 U. OF A.

TRAVEL TIME DIFFERENCE CATEGORIES

A. Walk Minus Car Travel Time Difference Zones

Less Than 10 Minutes	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	Greater Than 35 Minutes
2010	0060	0050	0320	0330	0340	All
2020	0310	0070	2110	2410	2340	Other
2210	2310		2230		2350	City
2220			2320			Zones
			2330			

B. Bus Minus Car Travel Time Difference Zones

Less Than 10 Minutes	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	Greater Than 45 Minutes	No Measure
0050	0010*	0150	0110	0120	0230	0240	0710	0930	1720
0060	0020*	0870	0320	0140	0260	0250	0810	0940	1800's
0070	0030*	0880	1130	0210	0340	0560	1010	0950	1960
2010	0040*	2430	2350	0220	0430	0720	1020	0960	2820
2020	0310	2540	2440	0330	0440	0820	1041	1031	2930
2210	2110	3021	2450	0410	0510	1120	1160	1032	2940
2220	2140*	3022	2520	0540	0520	1150	1170	1042	3150
2340	2230	3030	2530	0830	0550	1210	1320	1180	3160
	2250*	3110	2610	0840	0730	1410	1330	1190	4000's
	2310		2620	0850	0910	1421	1340	1310	5000's
	2320		2730	0860	0920	1520	1431	1550	6000's
	2330		2810	1140	1110	1530	1920	1910	7000's
	2370*		3050	1220	1440	1610	1930	1940	8000's
	2410			1230	1540	1620	1950	3130	
	2420*			2120	1630	4133			
	3010*			2130	1710	4120			
				2360	2640	2510			
				2460	2710	2630			
				2470	2950	3140			
				2720	3120				
				2910	4250				
				2920					
				2960					
				3040					

* NOTE: This marks 10 to 15 minute zones located outside the campus walking zone (Ref. FIGURE 3.5).

At this stage in the analysis quick handplots of the above mode split relationships were tried which showed clearly that a good graphical relationship had been found for both student and staff mode split, unlike the results of the previous staff travel time ratio curves. It was then feasible to proceed with a computer analysis to arrive at the curves of best fit in explanation of recent student and staff mode splits. Thus, second, third, and fourth degree polynomial and exponential functions were tried from which the most accurate curves were selected to represent mode split relationships.

In this regard, in the first round of curve analysis, results proved that the polynomial family of curves most accurately represent the student and staff travel time difference mode split relationships. The summaries of the sum of the square errors of curves analyzed (Ref. APPENDIX II) depicts significant improvements in going from second to third degree polynomial curves. FIGURES 3.7 to 3.11 which follow show the third degree polynomial plots of the student and staff travel time difference mode split relationships. These curves reflect all beneficial changes discussed in due course in this section of the report. The slight improvement in sum of square errors in further going to fourth degree polynomials is not justified because the first, or A term, in the equations becomes very small and less meaningful. Additionally the necessary equation of the line is one term more complicated. In every case exponential curves are not only less accurate (Ref. APPENDIX II), but are less consistently accurate between degrees of curves in mode split curve representations. On walk minus car mode split curves, exponential approximations had to be constrained to 100% on the ordinate which caused inaccuracies. The first round of

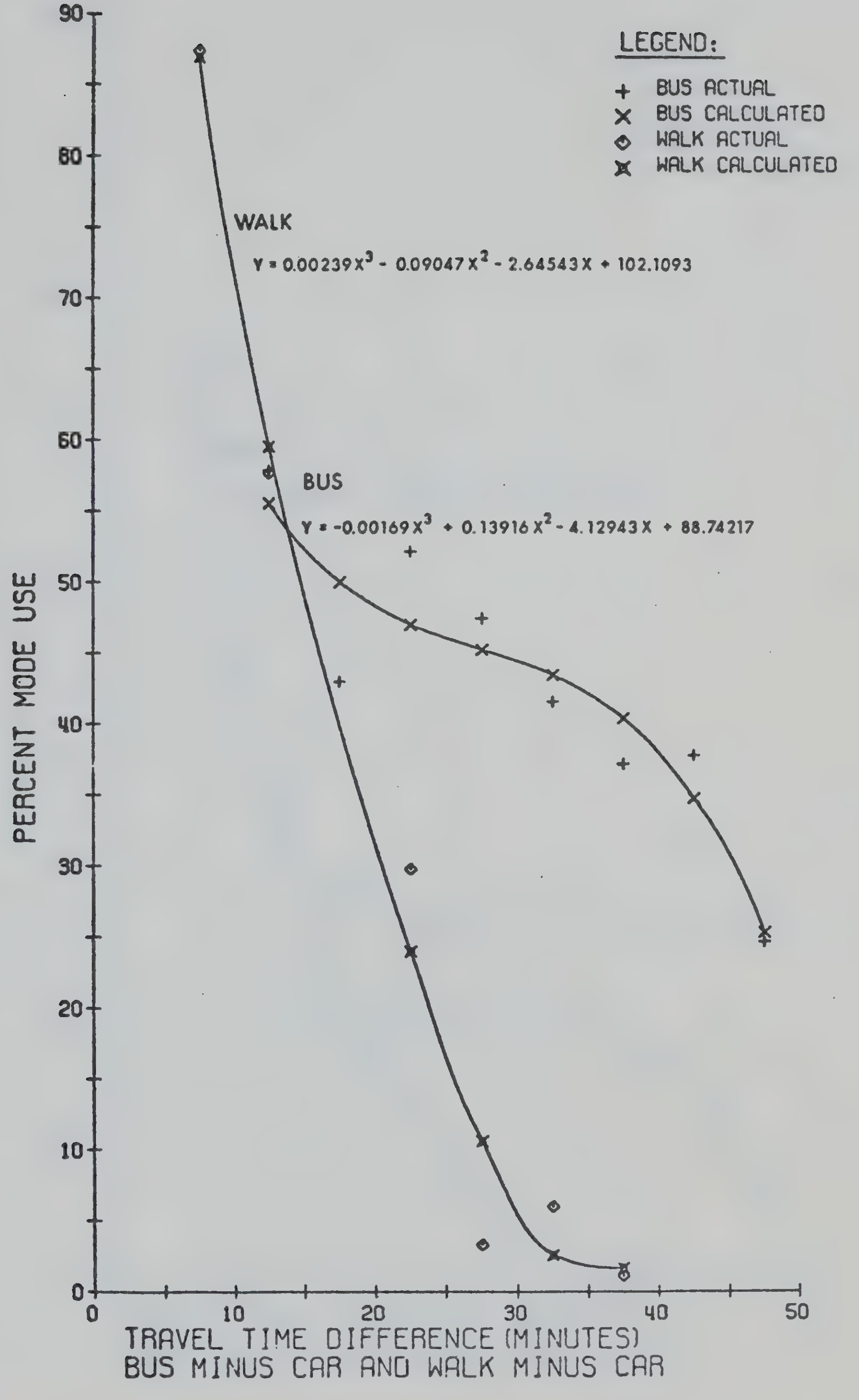


FIGURE 3.7. THE UNIVERSITY OF ALBERTA 1970/1971 STUDENT TRANSPORTATION MODE SPLITS

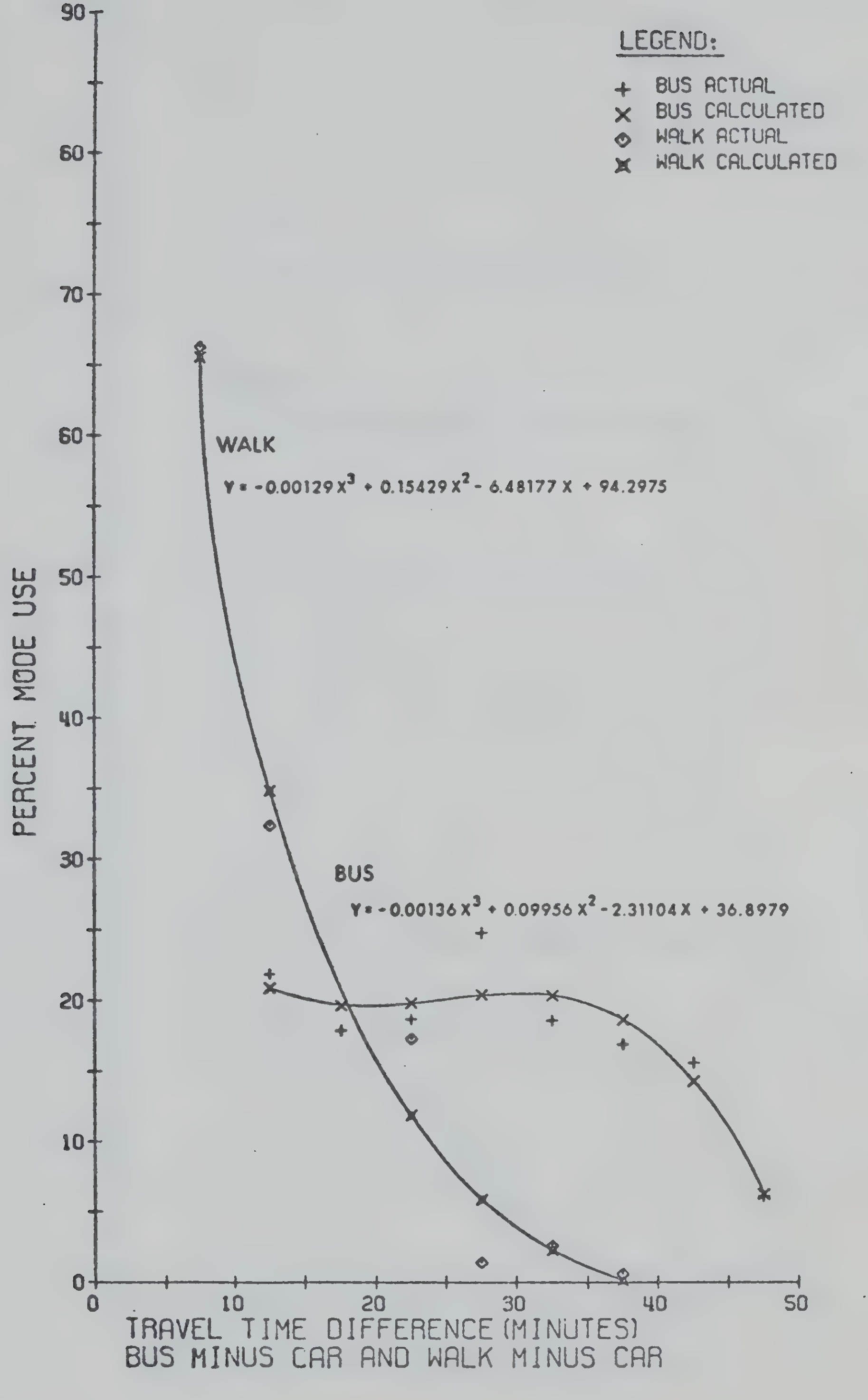


FIGURE 3.8. THE UNIVERSITY OF ALBERTA 1970/1971 FACULTY AND STAFF 100% EMPLOYMENT TRANSPORTATION MODE SPLITS

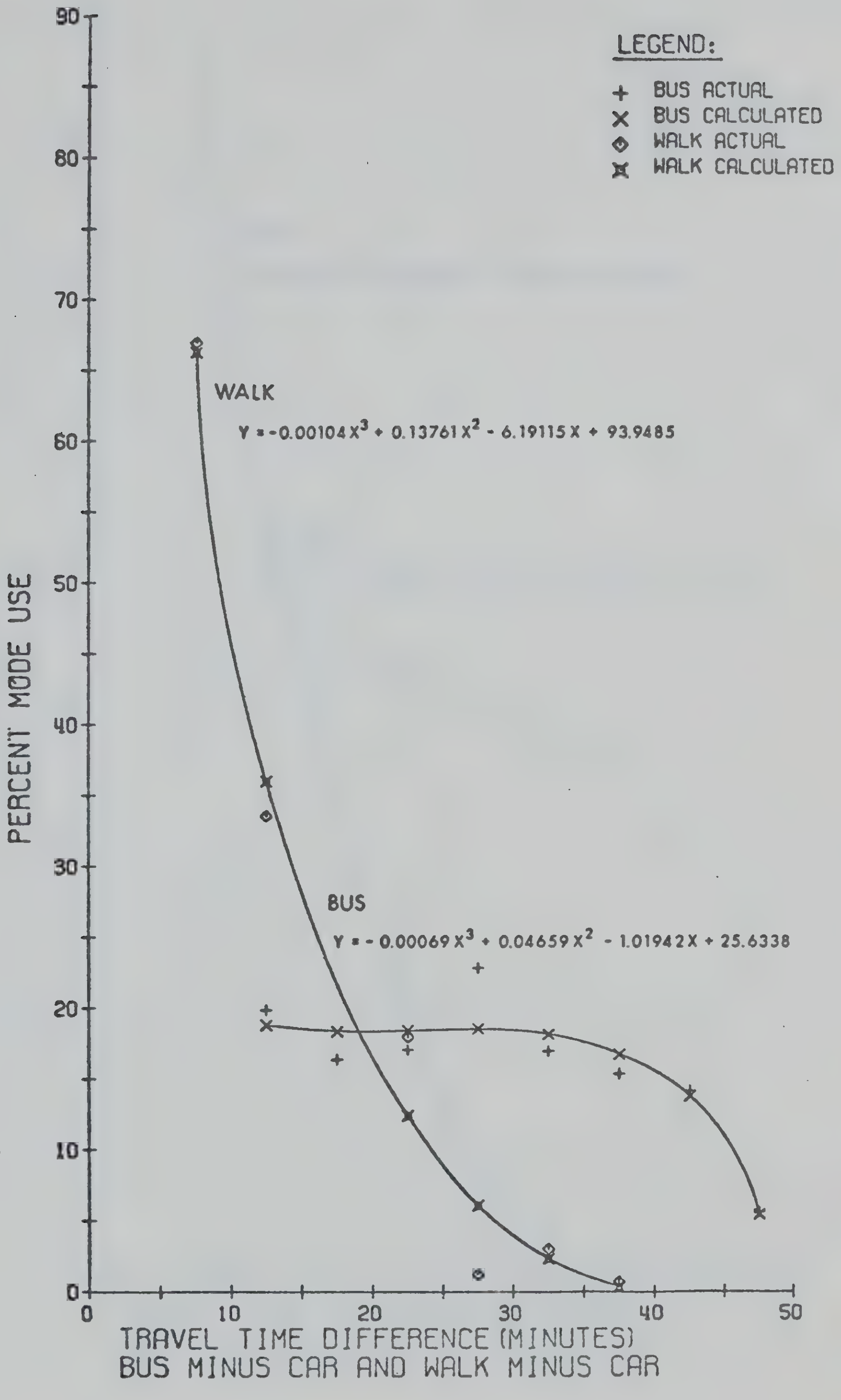


FIGURE 3.9. THE UNIVERSITY OF ALBERTA 1970/1971 FACULTY AND STAFF TRANSPORTATION MODE SPLITS

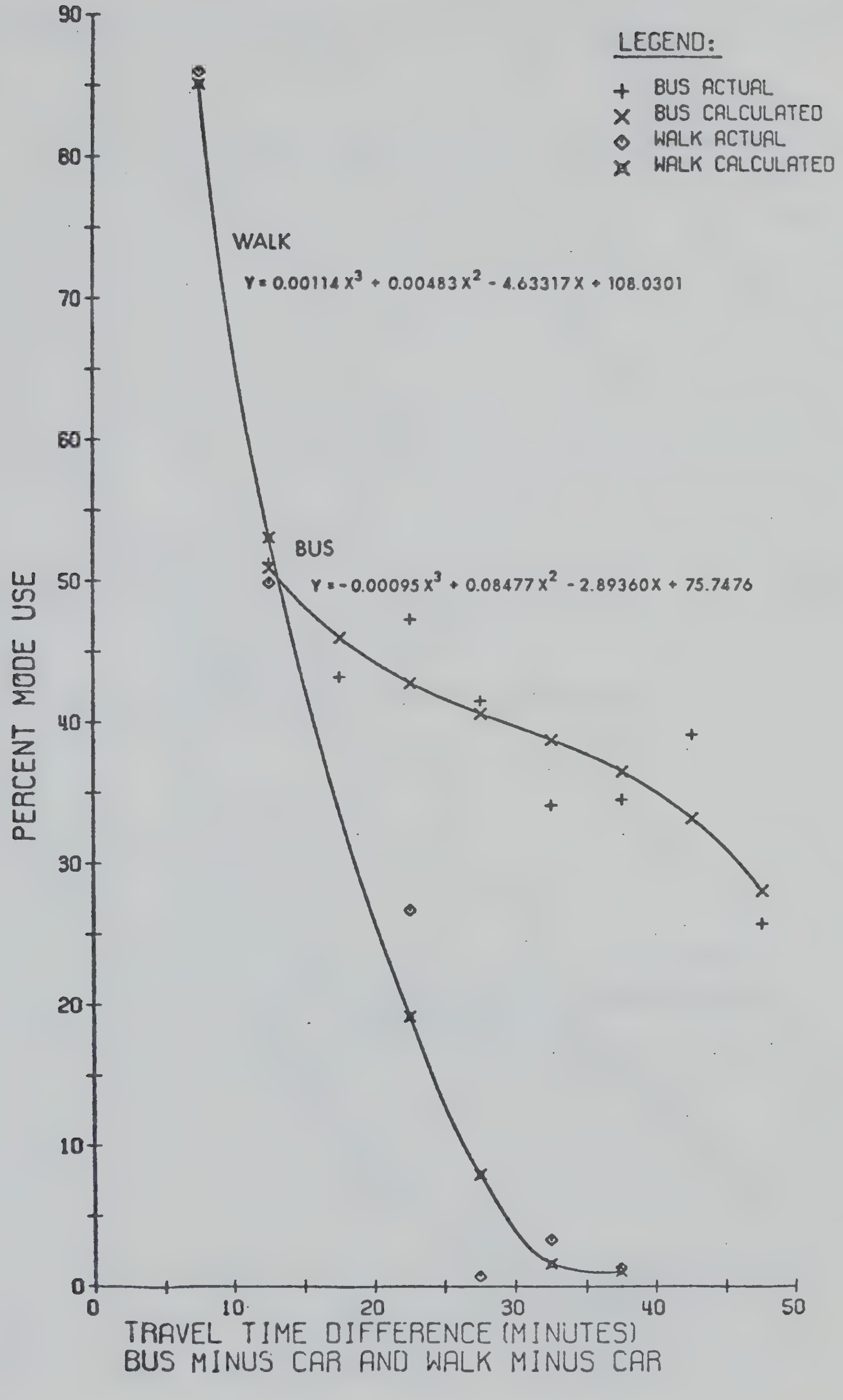


FIGURE 3.10. THE UNIVERSITY OF ALBERTA 1967/1968 STUDENT TRANSPORTATION MODE SPLITS

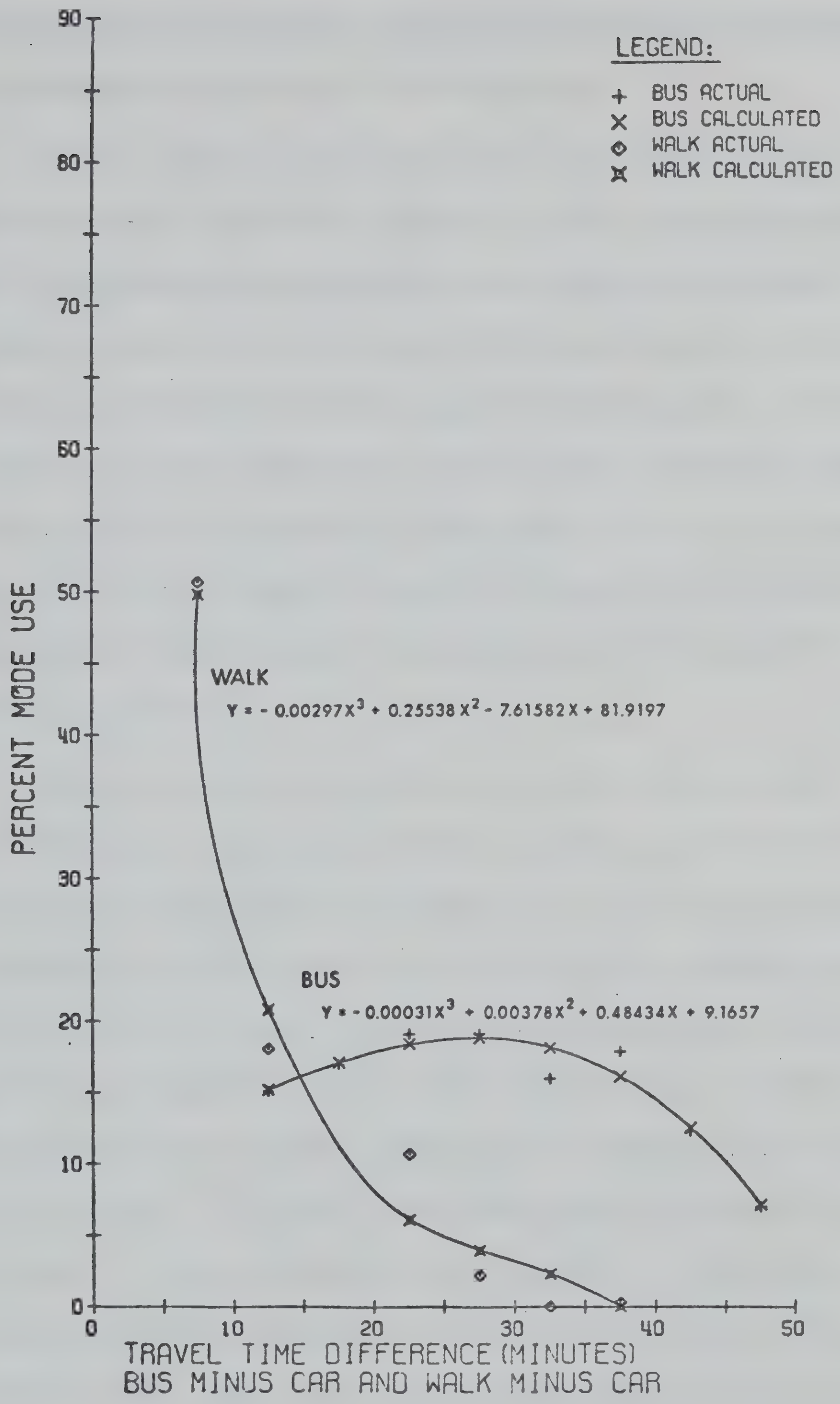


FIGURE 3.11. THE UNIVERSITY OF ALBERTA 1966/1967 FACULTY AND STAFF TRANSPORTATION MODE SPLITS

curve analyses ended therefore accepting third degree polynomial curves as most accurate for mode split determinations.

At this point in the development of the required curves, it was decided to perform sensitivity analysis on the polynomial family of curves, to ensure the best quality curves were being obtained. After due consideration of what this should best mean for the task at hand, it was further decided that the first plotted curve points, or mode splits for small travel time differences, are far more relevant to sensitivity analysis than points elsewhere in the curves. This is so because the density of U. of A. students is greatest closest to the campus where, concomitantly mode split percent estimates carry the greatest impact on transportation planning.

The first step in performing the sensitivity analysis therefore, was to examine the bus minus car first, or less than 10 minute travel time difference point, which falls under the curves and city land area of influence of the walk minus car mode splits for students and staff. An examination of this point complete with the METS zone basis thereof showed that a misleading indication of bus mode split for small travel time differences was obtained, particularly erroneous for the student mode split curves. In effect a bus mode split in METS zones adjacent to the campus, in the predominant walking area, is simply not relevant and would only tend to propagate a false mode split down the curve developed. Such a curve would lead to very inaccurate bus mode split results in the future, as small travel time differences spread to METS zones increasingly farther out from the campus. Thus the sensitivity analysis of the bus minus car mode split curves strongly suggested

excluding values for the less than ten minute travel time difference points, which was done.

Proceeding with the bus minus car sensitivity analysis, it was possible to isolate a sufficient number of METS zones outside the campus walking zone, in the 10 to 15 minute travel time difference zone, to obtain an accurate bus mode split value. As such this second plotted point is too great in importance to curve value, and range or breadth, to drop it in a sensitivity analysis and it was thus retained.

Regarding the walk minus car travel time difference mode split curves, all polynomial curves were again plotted by computer omitting the less than 10 minute point. The results of this analysis indicated minor improvement in the sum of the square errors (Ref. APPENDIX II). However, closer examination of the curve results and the basis of the first plotted point indicates no significant improvement as follows.

First, regarding all polynomial walk minus car mode split curves, a close examination of the third plotted, or seventeen and one half minute point, indicated quite conclusively an anomalous situation unique to this study. In essence METS zones 0050 and 0070 (Ref. FIGURE 3.5) representing this walk minus car mode split point, are two zones across the river from the U. of A. serviced by exceptionally good bus service. Additionally, as the two zones are located substantially in the Saskatchewan River valley, at a lower elevation than the university, walking is greatly curtailed because hill climbing is involved, which immediately gives a big travel time and convenience advantage over to bus. Thus, the actual walk minus car mode split curves are unnecessarily distorted by an inconsequential walking area. Further, however, again

discussing sensitivity analysis, if the third plotted point should be omitted as indicated, it throws too much importance on the first plotted point to omit it.

This leads to a very close examination of the whole basis of the first, or less than ten minute travel time difference point, for the walk minus car mode split. Regarding walking, it was found that the less than ten minute travel time difference zone involved METS zones 2010 (adjacent and southeast of the High Level Bridge), 2020 (Garneau), 2210 (U. of A. Campus), and 2220 (Windsor Park) (Ref. FIGURE 3.5); these are four extremely important close-in campus walking zones. The analysis therefore showed that the first plotted walking point is very accurate and thus when omitted in sensitivity analysis, adds a questionable result.

In summary the sensitivity analysis has yielded significant qualitative insight into the required mode split curve development. For the walk minus car mode split, and third degree polynomial curves, retention of the first plotted point is strongly recommended as is deletion of the seventeen and one half minute, or third plotted point. In this latter case APPENDIX II shows significant improvement in the sum of the square errors in this regard. In the case of the bus minus car sensitivity analysis, again the third degree polynomial curves provide the best analytical representation of the student and staff travel time difference mode splits. For all bus minus car mode split curves it is recommended that the first plotted point be omitted for reasons stated above.

At this point another type of sensitivity investigation is described, which was performed for the first time, on the 1970/1971 faculty and staff transportation questionnaire data. In essence transportation studies for students have involved receipt of questionnaire responses from over 94% of all day students, from which the 100% mode splits are, in fact, inferred. This is felt to be a safe assumption as the 5% to 6% missed are believed to behave similar to the 94% recorded. In the case of faculty and staff, however, studies involve analysis of transportation questionnaire responses from only 61% to 66% of known employees, a fact ascertained by questionnaire administration control and return success ratios (Ref. APPENDIX II). Thus in essence the sensitivity analysis here involved was to rationally infer and calculate the 100% staff employment travel time difference mode splits from the above information, and the known transportation patterns of 60% plus staff. Examination of this analysis shows that the lower questionnaire response from non-academic staff at the university was in fact resulting in an indicated use of bus of 15.3%, for example, rather than the more appropriate real figure of 17.2% (Ref. APPENDIX II).

For added accuracy in mode split projections, therefore, FIGURE 3.8 depicting the 1970/1971, 100% staff employment, transportation situation has been added for reference in CHAPTER IV. APPENDIX II shows the basis of these curves. Note that FIGURE 3.9 depicting the 1970/1971 staff first run results, prior to questionnaire return sensitivity studies, has been left in the report for information, being work more directly comparable to the 1966/1967 faculty and staff situation (Ref. FIGURE 3.11).

Examination of FIGURES 3.7 to 3.11 shows that generally the walk minus car and bus minus car mode split curves, which are superimposed in each year for clarity, compliment one another for students and staff. Thus at low travel time differences and/or closer in to the campus, the walk mode split starts off high, and then decreases with increasing travel time difference commensurate with a smooth transition to increased bus mode split importance. The bus mode splits, which show increasing use of bus service towards and beyond the fringe of the campus walking zone (Ref. FIGURE 3.5), increases for staff to a travel time difference of 22.5 minutes, then gradually declines. For students, however, the bus mode split starts off very high inside and outside the outer fringe of the campus walking zone, followed by a gradual somewhat uniform decrease in mode split to a travel time difference of 40 minutes. After this point the student bus mode split decreases more rapidly, incurring a sharp drop at the 60 minute point, being a fact somewhat deemphasized in the graphical, travel time difference method. TABLE III-2 shows the transit use drop quite clearly, as at these far points from campus car use increases to fulfill the transportation need. Regarding the complimentary nature of the travel time difference curves, FIGURES 3.7 to 3.11, it is interesting to note that the trained eye of a transportation engineer can envisage that a composite curve of the university's two mode splits would generate a curve similar to the usual single mode split curve of many central city areas (Ref. APPENDIX II).

A final very technical point resulting from the travel time difference mode split student and staff curve developments should be identified. In essence when either the relevant 1967/1968 and 1970/1971 student curves, or the 1966/1967 and 1970/1971 staff curves are given an

overlay comparison, increased mode splits or positive curve progression is readily identified. In regard to what this means it must first be recalled that the mode splits of all years were plotted specifically against the travel time differences as recorded for 1970/1971. Thus if one were to have had and used, for example, 1967/1968 travel time differences for the 1967/1968 mode splits, a close matching up of the 1967/1968 and 1970/1971 curves should be anticipated. In this regard a rough check of available travel time resources indicated that the 1967 bus minus car curves would be moved 2 to 3 minutes closer to their 1970/1971 counterparts if put on a 1967/1968 travel time basis. Both in this case and in that of the walk minus car curves however, three to five mode split percent unexplainable curve progression will still exist. This research project therefore wishes to identify this partly unexplained positive curve progression phenomena, which through the limitations of available research time, will be referred to the recommendations section of the report.

Concluding the travel time difference method it is reasonable to observe that it successfully represents The University of Alberta experience on recent mode split relationships. Thus FIGURES 3.7 to 3.11 will be valid in the mode split prediction work of the next chapter.

3.6. Data Stability

Since the start of student transportation studies at The University of Alberta in 1965/1966 (1), there has been a question as to the validity of student September registration transportation questionnaire responses. In brief, the question is: are the students' living accommodations and transportation patterns firm enough in September to base

planning studies on, or are there major changes of address and mode use occurring thereafter?

In the interests of answering the question, a second transportation questionnaire was completed by a sample of over 1,200 students in February through March, 1971, following their main first September, 1970 response. Because of the size of this sample, the 150 METS zones of the original analysis were collapsed on a rational basis into 31 larger zones to ensure no less than 15 students (average was 32 students) per zone, for reasonable levels of statistical accuracy. Please note APPENDIX II for the definition of the 31 larger zones. Then, following appropriate computer processing of all data, the two sets of responses to the salient questions were compared, the results of which follow for both mode use and travel time stability.

3.6.1. Travel Mode Use

Regarding travel mode use stability, TABLE III-7 shows September, 1970, to February-March, 1971, travel mode use shifts by students indicating that the main change was a 3.6% drop in bus transit use and a 2.5% increase in car pool use. The other minor changes are as seen on TABLE III-7. This particular change makes sense as, when students begin to mix socially after meeting in September each year, more car pools are formed to the loss of transit patronage. Nevertheless the question remains, does this just happen or is there a motivating force behind it? In this regard TABLE III-8 clearly shows that the major tendency to shift away from transit use occurs most predominantly in travel time zones of 60 to 70 minutes, on the north side of the City of Edmonton, and in travel time zones of 50 to 60 minutes in the south

TABLE III-7

THE UNIVERSITY OF ALBERTA STUDENT TRANSPORTATION MODE USE STABILITY 1970/1971

MODE	SEPTEMBER 1970 RESPONSE	MARCH 1971 RESPONSE	MASS DIFFERENCE MODE USE	MODE USE SHIFT PERCENT
Auto Driver	Mean Use 74.924 No. 278 Sum 20828.872	72.071 297 21,405.087	+576.215	+0.6%**
Car Pool	Mean Use 61.703 No. 101 Sum 6232.003	58.651 149 8738.999	+2506.996	+2.5%
Drop Off	Mean Use 57.905 No. 84 Sum 4864.020	48038 105 5043.990	+179.970	+0.2%
Bus	Mean Use 80.957 No. 416 Sum 33678.112	73.161 410 29996.010	-3682.102	-3.6%
Walk	Mean Use 87.432 No. 368 Sum 32174.976	85.889 379 32551.931	+376.955	+0.4%
Other	Mean Use 42.778 No. 52 Sum 2224.976	36534 58 2118.972	-106.004	-0.1%
Total	100002.959	99854.989	-147.970*	0.0%

*Note: Computing error of 1.48 students as mass difference should total 0.00

**Sample calculation is as follows:

$$\left(\frac{576.215}{\frac{100002.959 + 99854.989}{2}}\right) 100\% = 0.577 = 0.6\%$$

TABLE III-8

THE UNIVERSITY OF ALBERTA STUDENT BUS AND CAR MODE USE STABILITY BY CITY ZONES 1970/1971

(A comparison of student, September, 1970, and March, 1971 transportation questionnaire responses)

ZONE	BUS		CAR POOL		CAR		TRAVEL TIME ZONE FOR MAJOR TRANSIT USE DECLINES (min)	REMARK
	FALL	SPRING	FALL	SPRING	FALL	SPRING		
1	86.520 25	81.042* 24	56.500 2	35.000 6	76.667 6	44.5 10	20-30	Hi Rise Area
2	87.500 8	70.556* 9	100.0 2	70.0 1	87.5 4	100* 5		
3	79.455 11	78.500 10	75.0 1	50.0 1	71.833 6	67.5 6		
4	81.118 17	70.667* 15	75.0 4	65.0 2	98.0 5	78.182* 11	20-40	Hi Rise Area
5	82.750 20	51.190 21	56.667 3	43.000 5	72.917 12	71.667 12		
6	97.778 9	75.714* 7		55.000* 2	55.0 2	80.0* 3	50-60	
7	78.636 11	72.778* 9	60.000 4	47.714* 7	73.125 8	77.0* 10		
8	85.000 8	69.444* 9	30.0 2	48.750* 4	94.286 7	91.667 6	50-70	
9	85.385 13	90.385 13	73.333 3	68.750 4	64.0 5	75.0 4		
10	78.333 6	69.000 5	80.000 3	62.500* 4	81.667 6	82.5 8		
11	72.500 10	56.333* 12	69.643 14	77.111* 18	73.519 27	72.417 24	60-70	
12	78.800 25	66.304* 23	58.333 9	50.800 10	63.611 18	72.182 22	60-70	
13	85.313 16	78.750* 16	56.600 5	51.667* 9	75.867 15	75.625 16	60-70	
14	89.615 13	66.250* 12	77.50 4	73.000 5	90.0 4	85.714* 7	Greater than 70	

TABLE III-8 - (Cont'd.)

ZONE	BUS		CAR POOL		CAR		TRAVEL TIME ZONE FOR MAJOR TRANSIT USE DECLINES (min)	REMARK
	FALL	SPRING	FALL	SPRING	FALL	SPRING		
15	78.000 5	55.667* 6	77.5 4	85.833* 6	100.0 4	75.167* 6		
16	44.000 10	28.083* 12		23.667* 3	40.250 12	45.000 9	10-20	Hi Rise Area
17	100.00 4	27.500* 2	45.0 2	15.000 2	65.0 4	32.55 2		
18	50.0 2	50.0 1			85.0 2	18.3 3		
19	77.143 21	81.864 22	31.667 3	63.333* 3	67.5 8	72.875 8		
20	53.571 7	57.500 6	30.600 5	41.500* 10	67.0 9	44.5 10		
21	77.500 28	73.571* 28	66.0 5	60.333 6	55.556 9	61.182 11	20-30	Walk Up Area Rooming House
22	88.000 15	90.000 13		70.000* 2	78.571 7	79.375* 8		
23	88.136 22	84.773 22	72.5 2	15.0 2	63.5 6	79.167* 6		
24	88.652 23	74.739* 23	75.0 3	79.5* 8	82.222 9	53.0 10	40-50	
25	85.000 15	97.000 15	66.667 3		77.143 7	55.7 7		
26	76.167 12	69.091* 11	62.5 4	65.0 4	84.947 19	85.789 19	50-70	
27	88.056 18	74.300* 20	62.000 5	75.778* 9	86.667 12	70.231 13	50-60	
28	72.440 25	68.731 26	41.25 4	44.8* 10	62.0 17	64.667 15		
29	72.538 13	59.000* 14	37.0 4	68.333* 3	87.105 19	99.375* 16	40-50	
30	87.500 4	73.333* 3	100 1	70.0* 2	100 4	86.0* 5		
31	?	?	?	?	100 5	87.8 5		

side. Thus in keeping with the previous mode split analysis findings, it is doubly apparent that public transit use from origin to destination (U. of A.) becomes relatively unattractive for portal to portal travel time outlays exceeding 60 minutes. Additionally, it is evident that shifting to car occurs in some close in high-rise and walk-up apartment zones where, presumably, students live in closer proximity to other students, affording greater car pooling opportunities, etc.

The mode use stability analysis above was based upon students with fixed METS zone origins over the study period. A check was made, however, on students who did change their addresses between September and December 1970, which indicated that only 6% of a 500 student sample changed their city address, of which only 3.6% were of significance to transportation planning. In essence, many of those students who moved, moved within, or adjacent to, their original METS zone, still remaining within their original transportation corridor, and thus not substantially affecting transportation planning. Finally there was some evidence that the 3.6% might be further reduced if it were possible to control for students who moved, simply swapping METS zones and thus possibly nullifying the opposing move of another student with respect to transportation planning.

Concluding mode use stability, no such check as above has ever been done on university faculty and staff. However, it is evident in the research, and thereby assumed, that their moves are very low and of an insignificant number to affect transportation planning.

3.6.2. Travel Time

In addition to travel mode use stability, travel time stability was checked from student transportation questionnaire responses of September, 1970 to March, 1971. In this regard TABLE III-9 summarizes recorded mean travel times per zone for bus and car and broadly indicates good fall to spring travel time agreement. To clarify the use to which the additional travel time data was put, two aspects require mention. First the March, 1971, questionnaire travel time responses from 1,200 students, which in fact should be more seasoned responses, still can only be treated as additional responses to be considered at par weight with the 20,000 plus student and staff September, 1970, response. And secondly, in this second travel time analysis, what we are really searching for is either METS zones which change time zones and/or time changes sensitive to changes in travel time difference zones.

With these travel time sensitivities in mind, a thorough analysis of travel time data indicated the following changes. In the case of bus travel time, zones 4 and 13 only incurred a change in absolute time zone. More specifically, it was found that METS zone 0330 (of zone 4) changed from 40 to 50 minutes down to the 30 to 40 minutes portal to portal travel time zone. Also METS zones 1330 and 1340 (of zone 13) were brought down into the 60 to 70 minute portal to portal travel time zone.

In the case of auto travel times, zones 2, 5, 10, 12 and 13, only, incurred a change in absolute time zones. Specifically, METS zones 0110, 0120, 0140 and 0150 (of zone 2) now come down to being

TABLE III-9

THE UNIVERSITY OF ALBERTA

STUDENT TRAVEL TIME STABILITY 1970/1971

BUS				CAR			
ZONE	MEAN BUS TRAVEL TIME SEPT. 1970	MEAN BUS TRAVEL TIME MARCH, 1971	COMMENT	ZONE	MEAN AUTO TRAVEL TIME SEPT. 1970	MEAN AUTO TRAVEL TIME MARCH, 1971	COMMENT
1	20.694	22.178		1	12.419	12.733	
2	45.000	44.565		2	19.375	16.591	Analyze
3	49.130	51.944		3	18.696	17.222	
4	36.786	32.333	Analyze	4	14.385	12.655	
5	66.000	58.056	Analyze	5	29.464	25.833	Analyze
6	66.769	51.786		6	26.833	22.000	
7	43.600	46.583		7	18.696	16.200	
8	61.667	55.000	Analyze	8	17.471	19.118	
9	51.190	24.857	Error	9	46.350	13.048	Error
10	45.000	50.294		10	17.313	15.412	Analyze
11	68.250	68.295		11	23.810	19.886	
12	69.651	68.408		12	19.222	16.755	Analyze
13	82.647	66.774	Analyze	13	28.824	24.394	Analyze
14	68.913	63.864		14	30.714	30.000	
15	77.500	67.667		15	37.500	30.667	
16	19.234	15.661		16	9.750	9.493	
17	20.000	11.722		17	9.122	4.844	
18	11.308	58.581	Error	18	6.442	6.359	
19	24.925	28.184		19	14.730	14.061	
20	23.782	20.750		20	8.478	9.078	
21	28.240	22.100		21	14.961	12.462	
22	47.857	44.783		22	19.524	19.348	
23	35.167	34.259		23	19.643	16.423	Analyze
24	42.368	38.605	Analyze	24	18.200	17.561	
25	29.375	29.808		25	16.304	14.500	
26	62.333	58.333		26	27.031	22.516	
27	53.529	49.706		27	26.909	21.912	
28	29.189	30.000		28	14.436	13.732	
29	46.765	44.714		29	18.636	15.472	
30	63.333	59.500		30	26.667	28.000	
31	63.750	72.143		31	35.000	32.222	
All	42.972	41.771		All	18.033	15.285	

substantially within the 20 minute auto time zone; METS zones 0540 and 0550 (of zone 5) and METS zone 1330 and 1340 (of zone 13) now come down to within the 30 minute auto time zone. And lastly, the effects of the new Quesnell Bridge are such that METS zones 0920 and 0930 (of zone 10) and METS zones 1110 and 1020 (of zone 12) come down into the 20 minute portal to portal auto time zone, by being in part connected by a thin neck of this time zone, and leaving an island of 30 minute travel time in METS zones 0930, 0940 and 0950 (Valleyview, etc., Ref. FIGURE 3.1).

Concluding absolute travel time zone analysis above, note that the mode split analysis of this chapter has been performed on the basis of the time changes mentioned immediately above.

Regarding travel time changes suggested by the second student transportation questionnaire, and travel time differences, the analysis performed clearly indicated that the rather minor changes to bus and car time zones did not change travel time difference zones. This is chiefly due to the large (5 minutes) size of travel time difference zones in relation to the half to one minute changes in travel time differences incurred. Thus the original September, 1970 travel time differences were used exclusively in the travel time difference mode split analyses of this chapter.

The analysis of student portal to portal university travel time changes from September, 1970 to March, 1971, concludes with an overview of results from the matched response questionnaire samples shown in TABLE III-10.

TABLE III-10

THE UNIVERSITY OF ALBERTA STUDENT PORTAL TO PORTAL CAR AND BUS TRAVEL TIME CHANGES, 1970/1971

Date of Survey (34)	Travel Time Item	Transportation Mode	
		Bus	Car
September, 1970 Sample	Mean (minutes)	42.972	18.033
	Standard Deviation	34.893	23.660
	Variance	1217.546	559.809
	Relevant Cases N	909	959
	Total Cases	1269	1269
February-March, 1971 Sample	Mean	41.771	15.285
	Standard Deviation	97.366	8.726
	Variance	9480.105	76.139
	Relevant Cases N	993	1070
	Total Cases	1269	1269

From these results it can be seen that student travel time using bus and car dropped, but disproportionately (i.e. car by 2.748 minutes, vs. bus by 1.20 minutes) indicating a greater increase in the efficiency of car. Clearly this is a further motivation for the 3.6% September, 1970 to March, 1971, decline in public transit use (Ref. TABLE III-7).

3.7. Bus Cordon Count

During the week of November 23 to November 27, 1970, the City of Edmonton, Transportation Planning Branch, and the Office of Institutional Research and Planning (10) conducted a cordon count study of all inbound and outbound university transit patrons. On Monday, November 23, 1970,

an eighteen hour period, 6:00 a.m. to 12:00 midnight was taken while all remaining days used a 7:00 a.m. to 8:00 p.m. observation period. The purpose of the study was to determine university area transit patronage magnitudes and characteristics. Further it was hoped the knowledge coming from the study would aid in strengthening transit's capability to meet university-generated travel demands. A nearly identical study to the 1970 study was conducted again November 22 to November 26, 1971 (11), for the same purposes as above.

The purpose of this section of this research report therefore, is to compare the actual field counts of university transit patrons to university student and staff transportation questionnaire results covering the same time period (November, 1970, and/or the 1970/1971 university winter session), to prove up the quality of questionnaire data used in this report. The equitable comparison of necessity refers to inbound (home to work trip) passengers.

The second purpose herein developed will be to demonstrate the effects of improvement in public transit on mode split. In further support to this purpose brief information on improvements in public transit in recent years is referred to.

The following TABLE III-11 presents the actual field data secured during the first week long university transit (bus) cordon count study (10), capturing the 7:00 a.m. to 8:00 p.m. patronage situation.

Thus as can be seen the five day field study, average inbound transit passengers to The University of Alberta, specifically, comes to 6,775. This figure is then compared with university transportation questionnaire results as follows:

TABLE III-11

THE UNIVERSITY OF ALBERTA PUBLIC TRANSIT

CORDON COUNTS NOVEMBER 23-27, 1970, 7:00 A.M. TO 8:00 P.M.**

Weekday	Monday	Tuesday	Wednesday	Thursday	Friday	5 Day Average Passengers
Observed inbound passengers Total all U. of A. bus routes	7,064	6,904	7,641	7,424	7,445	
Less inbound University of Alberta Hospital passengers*	504	492	545	530	531	
True U. of A. inbound transit passengers	6,560	6,412	7,096	6,894	6,914	6,775

* NOTE: These figures are obtained by taking 593 inbound bus passengers alighting at the hospital actually observed Monday, less an estimated 15% for university people located in the Clinical Sciences and Corbett Hall buildings leaving 504 patrons, then adjusting each day in proportion to Monday's total observed 7,064 passengers.

Transportation Questionnaire Bus Passengers

1970/1971	Full-time day students	18,337 x 30.9%* Bus mode split =	5,666
1970/1971	Part-time day students	1,183 x 13.5%* Bus mode split =	160
1970/1971	Full-time equivalent faculty and staff	5,722 x 17.2%* Bus mode split =	984
		Total bus passengers =	6,810

* Reference TABLE III-2 and APPENDIX II.

** Source: Ref. 10.

Correlation Transit Passenger Cordon Count to Transportation Questionnaire Results

Questionnaire	--	6,810 passengers
Cordon Count	--	6,775 passengers
Difference		35 passengers
Difference as % of actual count	=	0.5%

The conclusion of this portion of the analyses is, therefore, that transportation questionnaire data received from The University of Alberta students and staff (Fall, 1970) compares very favourably with actual transit cordon counts (10) and must necessarily be considered as high quality data.

To demonstrate the effects of improvement in public transit service on mode split, examination of TABLE III-12 shows changes in transit patronages recorded in the 1970/1971 (10) and 1971/1972 (11) bus cordon count studies. As these two studies had compatible controls, goals and objectives, in every regard direct comparison of results is in order.

Following the 1970 transit study it was evident that a bus route to the U. of A. from west Edmonton, via the new Quesnell Bridge would have merit in attracting university ridership due to decreased public transit travel time. Thus in August, 1971, the new Edmonton Transit System bus route U4, across the Quesnell Bridge was put in service and patronage by the November 22 to 26, 1971, transit study (11) was duly recorded. Previous to the advent of the new bus route, and as per the November 23 to 27, 1970 study (10), university patrons utilized the

TABLE III-12

A COMPARISON OF TRANSIT PASSENGERS ARRIVING AND LEAVING THE UNIVERSITY OF ALBERTA

1970 AND 1971, 7:00 A.M. TO 8:00 P.M.*

		R1 - R2 CBD		Difference	R1 - R2 WHYTE		Difference	S6		Difference	U2 CBD		Difference	U2 LENDRUM		Difference
DAY		1970	1971	1970 - 1971	1970	1971	1970 - 1971	1970	1971	1970 - 1971	1970	1971	1970 - 1971	1970	1971	1970 - 1971
MONDAY*	Inbound	1940	1789	- 151	1196	1561	+ 365	822	892	+ 70	1324	1094	- 230	581	655	+ 74
	Outbound	2001	2494	+ 493	1042	1368	+ 326	1002	1169	+167	1225	976	- 249	743	758	+ 15
TUESDAY	Inbound	1603	1971	+ 368	1276	1582	+ 306	874	781	- 93	1262	1202	- 60	642	818	+176
	Outbound	2005	2189	+ 184	1024	1462	+ 438	998	1083	+ 85	1058	1043	- 15	697	698	+ 1
WEDNESDAY	Inbound	1724	2010	+ 286	1418	1497	+ 79	985	853	- 132	1436	1053	- 383	769	798	+ 29
	Outbound	2255	2030	- 225	1004	1352	+ 348	1131	1059	- 72	1133	1032	- 101	788	758	- 30
THURSDAY	Inbound	1888	1838	- 50	1442	1457	+ 15	877	780	- 97	1454	1170	- 284	677	701	+ 24
	Outbound	2285	2248	- 37	1044	1286	+ 242	997	1057	+ 60	1285	1173	- 112	723	627	- 51
FRIDAY	Inbound	1790	1894	+ 104	1346	1381	+ 35	827	794	- 33	1584	1188	- 396	716	766	+ 50
	Outbound	2241	2459	+ 218	992	1341	+ 349	1122	1108	- 14	1530	1272	- 258	710	741	+ 31
WEEK TOTAL	Inbound	8945	9502	+ 557	6678	7478	+ 800	4385	4100	-285	7060	5707	-1353	3385	3738	+353
	Outbound	10787	11420	+ 633	5106	6809	+1706	5250	5476	+226	6231	5496	- 735	3661	3627	- 34
TOTAL IN & OUT		19732	20922	+1190	11784	14287	+2503	9635	9576	- 59	13291	11203	-2088	7046	7365	+319

*Monday's count ran from 6 a.m. to 12 p.m.

Transit passengers for 6 A.M. — 7 A.M. and 8 P.M. to Midnight have been separated.

U6		Difference	U5		Difference	U4		Difference	Totals		Unassigned	Totals		Difference	%	
1970	1971	1970 - 1971	1970	1971	1970 - 1971	1970	1971	1970 - 1971	1970	1971	1970	1970	1971	1970 - 1971	Increase	
405	395	- 10	501	402	99	NEW	493	+ 493	6769	7281	295	7064	7281	+ 217	+ 3	
362	396	+ 34	499	423	- 76	ROUTE	436	+ 436	6874	8020	392	7266	8020	+ 754	+10	
407	396	- 11	478	364	-114		597	+ 597	6542	7711	362	6904	7711	+ 807	+12	
403	424	+ 21	379	399	20		395	+ 395	6564	7693	593	7157	7693	+ 536	+ 7	
398	458	+ 60	633	390	-243		524	+ 524	7363	7583	278	7641	7583	- 58	+ 1	
414	425	+ 11	509	419	- 90		473	+ 473	7234	7548	347	7581	7548	- 33	---	
421	458	+ 37	514	458	- 56		377	+ 377	7273	7239	151	7424	7239	- 185	- 2	
449	466	+ 17	450	417	- 33		394	+ 394	7233	7713	399	7632	7713	+ 81	+ 1	
377	352	- 25	468	404	- 64		495	+ 495	7108	7274	336	7444	7274	- 170	- 2	
416	389	- 27	497	415	- 82		394	+ 394	7508	8119	97	7605	8119	+ 514	+ 7	
2008	2059	+ 51	2594	2018	-576		2486	+2486	35055	37088	1422	36477	37088	+ 611	+ 2	Total % Increase Inbound
2044	2100	+ 56	2334	2073	-261		2092	+2092	35413	39093	1828	37241	39093	+1852	+ 5	Total % Increase Outbound
4052	4159	+107	4928	4091	-837		4578	+4578	70468	76181	3250 70468	73718	76181	+2463	+ 3	Total % Increase 1970 1971
											73718					

* Source: Ref. 11.

services of the Jasper Place bus routes to downtown, transferring to the U2 bus across the High Level Bridge at 109 Street and Jasper Avenue (Ref. FIGURE 3.5). Additionally the U5 bus originating out of the Jasper Place transit terminal and crossing the Groad Road to U. of A. was used. Thus from TABLE III-12 it can be seen that the new improved U4 bus route attracted 4,578 weekly (7:00 a.m. to 8:00 p.m.) university riders, for a net increase of 1,653 riders, over and above the 2,088, U2-CBD, and 837, U5, decrease in ridership. This particular net increase in recorded university transit patronage was the chief contributer of the overall 3% transit increase, and is also a factor in the further evolution of transit mode splits (Ref. TABLE III-2).

Thus The University of Alberta behaves in a positively sensitive manner to improvements in public transit.

Regarding improvements in public transit to the campus in recent years, APPENDIX II summarizes some relevant information. Through the cooperative efforts of The University of Alberta Traffic and Parking Committee, and the Edmonton Transit System over many years, transit service has experienced dramatic growth from a dozen buses a day serving Windsor Park (Ref. FIGURE 3.5), to the impressive dynamic transit service of the present.

In conclusion public transit service to the campus has indeed become well used and respected by university area people, having thus been a key determinant in influencing campus mode split in recent years.

3.8. Campus Parking Situation

The purpose of this section of the report is to analyze the campus parking situation, to articulate the nature of it, and to

determine the relationship of parking to recent choice of travel mode by students and staff. In this regard discussion will centre around FIGURE 3.12 which presents visually some quantitative aspects of campus parking over 7 years.

With the rapid growth in university enrolment and faculty and staff since the mid-fifties (Ref. TABLES II-1 and II-2) and commensurate with greatly expanded city size, city affluence, and use of the automobile, the campus has experienced a need to store more than double the number of automobiles from 1958 to 1970 (Ref. TABLE III-13). Yet the nature of the campus use of automobiles has changed very significantly, as has the parking system from a loose uncontrolled arrangement to a well regulated much more systematic campus service.

Thus as FIGURE 3.12 and TABLE III-13 show essential parking demand has gone from an apparent high of 6,300 auto registrations in 1965 to 4,751 parking permit holders in 1970, while campus parking stock has increased from 4,170 to 4,750 in 1970. A description of the conditions that brought parking supply and demand more in line with one another is in order.

In 1965 which was the year that witnessed peak apparent parking demand, 7,844 campus individuals started to register automobiles for the 1965/1966 university year. More specifically 2,544 faculty and staff automobiles were registered, with an estimated 250 plus being second family cars, and 5,300 students at September student registration indicated they "had access" to a car. Further of the 5,300 approximately 3,800 to 4,000 students followed up on their initial "auto access" indication, by going to the campus parking office following

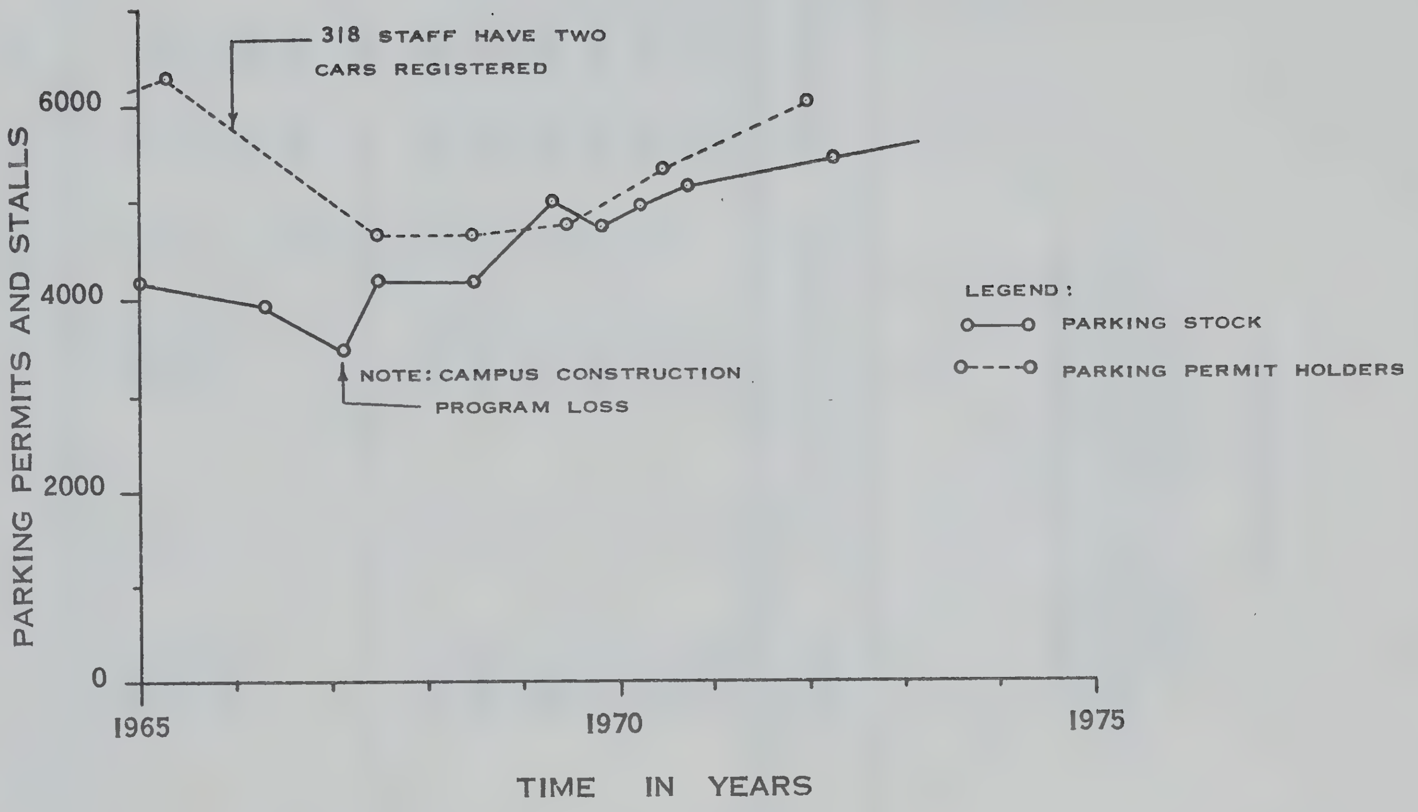


FIGURE 3.12. THE UNIVERSITY OF ALBERTA RECENT PARKING STOCK AND AUTOMOBILE REGISTRATIONS

TABLE III-13

THE UNIVERSITY OF ALBERTA
HISTORIC AUTOMOBILE REGISTRATIONS
AND PARKING PERMIT HOLDERS**

ACADEMIC YEAR	FACULTY AND STAFF	STUDENTS	TOTAL
1958 - 1959	650	1,150	1,800
1959 - 1960	800	1,350	2,150
1960 - 1961	1,180	1,700	2,880
1961 - 1962	1,300	2,225	3,525
1962 - 1963	1,500	3,200	4,700
1963 - 1964	1,737	4,800	6,537
1964 - 1965	2,300	5,200	7,500
1965 - 1966	2,544	5,300	7,844
NOTE: From this point on figures are reported as parking permit holders.			
1967 - 1968			4,641
1968 - 1969			4,636
1969 - 1970	2,464	2,287	4,751
1970 - 1971	2,755	2,570	5,325
1971 - 1972	2,926	3,095*	6,021

*NOTE: 300 additional students who applied did not accept available space.

** Source: University of Alberta Parking Office.

registration and fully registering automobiles at their disposal. The 3,800 to 4,000 did include all car pool cars and in fact, as a year end figure, included all illegally parked students who were made to register automobiles throughout the year. In 1965 Windsor Park, North and South Garneau, being university peripheral neighbourhoods (Ref. FIGURE 3.5), were essentially low density single family type residential neighbourhoods, with many university students living there. These neighbourhoods generally afforded students an additional 1,500 curbside parking spaces with few parking restrictions. In addition, 1,070 of the 4,170 campus stalls were free of charge, general university staff stalls, used extensively by everyone. Thus in summary, campus area parking in 1965 was in fact more than adequate to serve both essential, and non-essential (i.e. auto trips from the inner walking zone) auto parking needs with few complaints to the parking office. So called non-essential trips may have been viewed as otherwise by some individuals simply because congestion was at a low level in the university area and the personal convenience of short-tripping with automobiles was enhanced.

Then in 1967/1968 the parking system was changed dramatically to a more well regulated and manageable systematic operation, and put more on a break even financial basis with increased parking charges. The net result of so doing was to get vastly improved parking stall utilization out of more efficient lot sizes, parking zones, and parking distributions, such that 4,641 parking permit holders were satisfied with 4,177 parking stalls with no genuine parking need left unanswered. In essence this was made possible by elimination of non-essential use of the automobile which, through increased automobile operating costs and

increased campus congestion and travel time outlays, in relation to walk and a vastly improved bus service, was quickly becoming an unattractive affair anyway. Student and staff car pools increased in this time as did passenger drop-off, and walking from new high-rise and walk-up apartment developments in the campus area.

With these changes and the addition of two efficient, 800 car parking structures and other beneficial parking system changes, including creation of bigger and better campus parking zones, by 1970/1971, 5,325 parking permit holders (of which 350 are alternate or second car permits) were adequately served with 5,162 parking stalls, being an increase of only 23.8% in campus stalls in 5 years. More specifically 2,755 faculty and staff parking permits were issued and no one in this category who wanted parking was refused. As for students in 1970/1971, 3,872 applications for parking permits were first made at autumn registration, with 2,570 permits issued on first call. Although it immediately appears that many students did not get essential parking this was not the case. Subsequent to the first allocation of stalls in September 1970, 1,207 letters offering campus parking were sent to the unsuccessful applicants offering space at $36 per university winter session year at lot G, Corbett Hall, yet only 50 students came forward to obtain it. Again a second letter mailed to 200 students later in autumn allocating them space in lot G generated no response. Finally during the autumn of 1970, 63 letters from students complaining about parking were received and processed by the parking office, and all these students were allocated satisfactory parking space (Ref. APPENDIX II), thus indicating student parking was available throughout 1970/1971.

The above research spanning several years leads to the following observations regarding campus parking. It appears in general that campus parking can encounter four types of constraints as follows:

(1) Students who live close in to campus and who choose not to form car pools are constrained by receiving a low priority vying for campus parking. That is a policy imposed type of constraint. Yet even these few individuals were offered space in 1970/1971.

(2) There most definitely can be a twofold type parking inconvenience constraint, either by the parking being located in a geographically unsuitable area (e.g. Corbett Hall), or by receiving a parking stall with undesired features such as no electrical plug-in in a winter oriented city.

(3) There appears to exist a psychological constraint amongst potential campus parkers particularly students. In essence either their assumed fear or dislike with the apparent bureaucratic process of competing for parking, or the possible outcome of the process turns certain individuals off, and/or precipitates other travel arrangements being made. Or, a more practical attitude evolves whereby the desire to penetrate the area of apparent traffic congestion on campus and/or hunt for parking in large parking zones and suffer the inconveniences of running a vehicle in winter, simply is not attractive to certain individuals.

(4) There could and can exist an absolute parking shortage constraint. To date the parking office has successfully solved these constraints, with the possible exception of the

geographic and stall feature constraint, for the vast majority of student parkers.

This leads to observations on actual parking determinants. The geographic and parking feature problem often may add to portal to portal travel time and inconvenience which may make walking or busing more attractive. In essence walking straight off a warm bus into The University of Alberta buildings may be found to be vastly superior to parking far away, running the risk the car won't start, scraping snow off windows and overall economics. Yet the university, no more than the city, can be expected to provide for all the potential parking demand on "the 100% corner", but can and now does run buses past it.

The economic determinant to parking must be considered very interesting. In 1970/1971 a student peripheral zone yearly permit cost less than a student season bus pass ($20 vs. $30 first term and $35 second term) which represents a come-on to student parkers. Yet there is increasing evidence that the economics of the overall automobile operating costs situation is dissuading some students over to more economic modes, which of course includes car pooling. The student car status thing of the late 50's and early 60's has in part given over to the more practical considerations of education, time and money; and such modes as busing, walking and bicycling in season, have definitely come more in vogue. The high end of the student age profile has gone up coincidentally as universities have moved more into an era of education for lifelong learning.

Further regarding the economic and time and convenience parking determinants, commensurate with increased student part-time jobs, more

flexible class schedules, and more diverse living patterns, many student parkers require no more than 1 to 3 or 4 hours parking at a time. For this reason certain student parking lots including car park one at a fee of $.50 per visit as a student visitor are experiencing a 25% oversell (and still appear to have available space) and parking stall utilization has never been better. Although this might immediately appear to be expensive parking it is not necessarily so, as there obviously are many temporal patterns to student and staff parking or transportation needs, often with other modes involved (regular multi mode use).

Although there are other determinants to parking the research will conclude by pointing out that a vastly improved public transit system through campus has quite obviously had a pronounced beneficial effect on reducing campus parking demands. Coincidentally it has improved prevailing traffic conditions for essential vehicular traffic.

It is therefore the findings of this analysis that by and large, there has been no significant real parking constraint up to and including the 1970/1971 academic year at the campus. It is quite evident, however, that as The University of Alberta grows further there is a strong probability that a parking constraint could be encountered (Ref. FIGURE 3.12 eludes to this). This is so because a very heavy building program has greatly reduced surface lot opportunities, and parking structures lag demand, impose potentially serious academic land use constraints, and are costly. The research findings would strongly suggest that the mode split to date has evolved more from good bus service, close in high-rise and walk-up apartment development

intensification, cost push auto economics, and increased city peak hour traffic congestion, than from parking stock quantity per se.

3.9. Mode Split Analyses Summary

The purpose of the mode split analyses chapter has been fulfilled and the salient results are hereby briefly summarized.

Section 3.2 of this chapter emphasizing mode use trends showed that there has been a considerable shift in mode use to public transit in five years with a complimentary decline in auto driver use, although car pooling increased. Portal to portal transit travel time outlays are high in many cases (Ref. FIGURE 3.2) and moreover the travel time situation in the City of Edmonton has worsened significantly in five years. With the great increases in high density apartment developments adjacent to campus, in addition to increased traffic (frequently A.M. and P.M. peak hour congestion), walking has grown dramatically in importance.

In providing analytical descriptions of mode split behavior the travel time ratio method did not work because the utility of the major mode travel times is too equal, due to substantial staff neighbourhoods adjacent or close to the campus. This situation is quite different from the proximity of city wide employee residential neighbourhoods to a central business district where clean-cut separations exist.

The travel time difference method, however, yields good analytical definition of The University of Alberta student, faculty and staff mode split behavior, particularly when three (car, bus, walk) and not the usual two (bus, car) major modes in use are recognized.

The various analyses of this chapter have indicated quite conclusively that student and staff transportation questionnaire responses are as high a quality as could be expected, and as evidenced by close correlations to actual traffic field studies, etc. (Ref. Sections 3.6 and 3.7).

Comparable campus transit ridership studies of 1970/1971 (10) and 1971/1972 (11) prove The University of Alberta to be positively sensitive to improvements in transit, which in turn induces continuing mode split evolutions favouring transit.

The transportation service most subject to imposition of a travel choice constraint, being campus parking, has not demonstrated any significant measure of constraint up to and including 1970/1971. By and large all staff plus the vast majority of seriously intending student campus parkers have received campus parking space service.

CHAPTER IV

APPLICATION OF MODE SPLITS IN PREDICTION

4.1. General

The previous chapter of the study has explored the major determinants of recent transportation mode use at The University of Alberta. The analytical relationships developed have afforded a good explanation of changes in mode use by students and staff from 1965/1966 to and including the 1970/1971 academic year. Additionally, campus parking and public transit use trends have been recorded for the 1971/1972 academic year which fully support study findings.

The purpose of this chapter of the study, therefore, is to demonstrate the application of the mode split technology to date upon the campus population projections of CHAPTER II, to estimate the possible campus transportation mode splits in one decade's time to 1981/1982. In so doing, a beneficial resultant purpose has been to focus more clearly on problem areas in making future mode split predictions, complete with suggesting possible corrective measures. The study at hand has developed the methodology and essential analytic components of a campus transportation model which should be reestimated as the new and better data required is generated.

The problems encountered in estimating the possible future mode splits are as follows:

1. At this time of changing transportation planning emphasis in the City of Edmonton (54, 55) future portal to portal travel times via city roadways cannot be measured. Additional future data here would thus be of value. Study estimates are the very best that can be done at this time on available travel time knowledge.
2. The future city residential locations of students and staff has a bearing on campus mode split. This problem is not as critical as travel time, yet should be rechecked in several years time along with the size and population distribution of Edmonton.
3. For the case of the city having the proposed Edmonton Rapid Transit System (13), additional data is needed to estimate the diversion to this facility, of university bound trips. This study, therefore, suggests an origin-destination and public transit diversion study to measure trip diversion.

The chapter thus proceeds with an estimation of future portal to portal travel times in the City of Edmonton based on observed changes in five years. This is followed by use of the travel time difference curves (Ref. FIGURES 3.7 to 3.11) to obtain the mode splits. In CHAPTER V a comparison of the possible mode splits, with and without rapid transit (13), yields substantial insight into campus transportation planning.

4.2. Estimated Future Travel Times 1981/1982

4.2.1. Background Information Search

Upon proceeding with this important facet of the research project, a thorough search was made for available information on future

travel times in the City of Edmonton in order that nothing of particular value to the project would be overlooked.

The first item upon travel times that was viewed was Associated's projected 1975 bus transit travel time zones to U of A from all city points (1), which were found to be too optimistic in view of the transit travel time worsening in five years (Ref. Section 3.2).

Next, from the City of Edmonton Traffic Engineers, city arterial link automobile travel times to 2001 (56) were thoroughly examined in relation to the 1970/1971 portal to portal automobile travel times of this study with the following results. First, upon due compensation for the different natures of the two travel times, it was found in comparison that the two sets of travel times, worked out to U of A, showed broad similarity which was considered good. However, the so called 2001 link times, or time trees, worked out to U of A were of magnitudes not far removed from the 1970/1971 portal to portal travel time, again proving to be too optimistic for the purposes of this study. Secondly, although a good broad agreement of travel times was found, some wide, specific route, travel time differences to U of A existed such that the use would have biased the study. The net result of the review of the 2001 link times was that a scaled-up version of the portal to portal automobile travel times of this study was considered wise to proceed with.

The third major travel time item reviewed in the research proved to be interesting and quite relevant to the portal to portal transit travel times recorded in this study. In the spring of 1972, Kates Peat Marwick and Company performed transit serviceability

characteristics studies (33) of the Edmonton Transit System including a study of travel times between city points. Their travel times, which included walking time from zone centroid to bus stop, waiting and riding time and, where applicable, transfer time, were compared with the travel times of this study as follows. From both the U of A and the Kates Peat transit travel time information, representative time-distance (airline distances) rays were scaled off the city plan and duly recorded (Ref. APPENDIX III). This measurement procedure was followed as the best random approach to the question, as the exact route of U of A people is unknown. As the U of A distance measurements were all to the U of A centroid from north side Edmonton, while the available Kates Peat information was confined to north side Edmonton, a bridge penalty of five minutes was subtracted from each U of A time-distance measurement. Next, as the Kates Peat travel times lack the true portal to portal walking times, found in the U of A times, these were added as two minutes house door to neighbourhood zone centroid time, and five minutes 87 Avenue bus stop to U of A zone centroid (Central Academic Building second floor elevator doors) walking time, per time-distance measurement. Such a comparison of the two recorded times then shows that an inch of portal to portal transit time is worth 4.87 minutes in the U of A study, and 4.91 minutes in the Kates Peat Marwick study, working at the one inch equals 2,000 feet city plan scale (Ref. APPENDIX III). These results therefore confirm beyond doubt that 1970/1971 portal to portal transit travel times, particularly from the west and north parts of the city to U of A, are truly as bad as recorded, and thus reemphasize the quality of data at hand. It would appear, however, that in the intervening 20 months between studies (September

1970 to May 1972) portal to portal transit travel times likely did not get significantly worse. In conclusion, the review of the Kates Peat Marwick travel time item lends confidence to the study yielding similar results to the findings of this project.

The search for future travel time information ended with finding, and subsequently using, the De Leuw Cather proposed rapid transit travel times (13) (Ref. APPENDIX III).

4.2.2. Development of Future Travel Times

The importance of this element of the analysis was recognized at the outset, and thus the following thorough and exhaustive study was performed to obtain the estimated future travel times.

First, for public transit (bus), the recorded university 1970/1971 portal to portal transit travel times for all METS zones were compared with the Edmonton Transit System, autumn 1970, published transit schedules with the following results. For south and southwest, south side Edmonton, recorded portal to portal transit travel times were found to be close to an average of sixteen minutes greater than schedule time including published running and transfer times. This is the walk to and from your home and work doors, plus waiting for the bus time henceforth called the transit portal time factor. It is appropriate to note at this point that the general campus walk, from the bus stops of 1970/1971 along 87 Avenue to the campus centroid, averages an estimated 4 to 5 minutes alone. For east and southeast Edmonton the transit portal time factor was found to average 17 minutes, while non central north side Edmonton METS zones were found to average 22 minutes. (See example calculation APPENDIX III.) The transit portal time factors for central

zones (METS Zones 0010 to 0070, 0110 to 0150, 0310 to 0340, and 0730) on the north side were found to be proportionally less than 22 minutes, falling generally in three tiers namely 6 to 7, 15, and 18 minutes going out from U of A along transit routes. The central south side METS Zones 2020 and 2220 had transit portal time factors of 6 minutes, while Zones 2010, 2230, 2310 and 2340 averaged 12 minutes. Going to sketchy information supplied by a different carrier, the St. Albert transit portal time factor was found to be 24 minutes while Sherwood Park's factor simply could not be deduced from available schedule information.

Having thus obtained the transit portal time factors for the U of A for 1970/1971, transit service changes (improvements) since then were examined in great detail, once again delving into all relevant up-to-date published transit schedules. In this regard the new (September, 1971) U4 bus line across the Quesnell Bridge to U of A was assessed, as well as the important transit service improvements of November 27, 1972, to the north side Edmonton Transit System, U5, U6, N5/U2, N10/U2 and N12/U3, university bound bus routes. In essence, transit schedule time to U of A from all city points was assessed by searching out the shortest time path in all cases, and assuming the use of those bus sections that make the most efficient transfer connections with respect to arriving on campus for 8:00 or 9:00 A.M. lectures or labs. As this element of the research was conducted just at the time of commencement of the improved north side service, a few logical, present and future, planned and desired, efficient transfer hookups were assumed to exist in obtaining travel times. An example is a timely A.M. peak N5 to U5 transfer hookup which has been a hit and miss affair through 97 Street left turn traffic congestion. Other desirable transfers involve the N12 along 82 Street.

The final step in obtaining the transit travel times, which can be used as future travel times as subsequently shown, was to add to all scheduled transit times arrived at above the appropriate transit portal time factors of 1970/1971, which are assumed to remain generally constant in the future, with one exception. In short, it is believed that several southwest, north side, city METS zones serviced by the U4 bus will behave more like south side zones to 1981/1982, and hence a transit portal time factor of 19 and not 22 minutes was used.

Lastly, portal to portal transit travel times for six new city areas (Ref. TABLE II-22) were estimated on an express bus to U of A basis for 1981/1982, using time-distance and adjacent METS zone travel times as the basis for calculations. The time estimations included the necessary time for internal subdivision bus circulation in order to be complete in every respect. Also, express bus, direct to U of A, was assumed for both St. Albert and Sherwood Park for 1981/1982 complete with a portal to portal travel time of 60 minutes. This travel time estimate is felt to be quite reasonable and highly desirable as transit use drops off sharply after 60 minutes. Concluding future oriented transit travel time, TABLE IV-1 summarizes study estimates for all METS zones and the six new and proposed city residential areas.

At this point in the study future travel time strategy was duly considered as follows. First, for transit, it was found that for the total of all north side Edmonton METS Zones, the beneficial transit improvements aforementioned saved an average of 14 minutes of portal to portal travel time in comparison to recorded 1970/1971 times. This indeed is a very significant beneficial change which will show up subsequently in Mode Splits. Further, a detailed examination of Associated's

TABLE IV-1

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982 BUS MINUS CAR PORTAL TO PORTAL TRAVEL TIME DIFFERENCES BY METS ZONE (Minutes)

METS ZONE	BUS TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE
0010	18.9	20.2	--
0020	17.9	18.2	--
0030	24.4	19.0	5.4
0040	22.4	17.9	4.5
0050	15.4	16.8	--
0060	15.0	19.0	--
0070	16.5	18.8	--
0110	40.0	25.9	14.1
0120	45.5	25.6	19.9
0140	42.1	24.6	17.5
0150	34.4	24.0	10.4
0210	37.3	24.3	13.0
0220	42.7	28.4	14.3
230	34.3	22.6	11.7
240	37.0	25.4	11.6
250	47.9	27.0	20.9
260	46.0	30.0	16.0
0310	21.6	17.9	3.7
320	28.0	17.6	10.4
330	28.0	18.1	9.9
340	35.5	17.8	17.7
0410	45.8	27.3	18.5
430	53.0	33.5	19.5
440	53.7	34.4	19.3
0510	46.6	29.4	17.2
520	50.4	31.8	18.6
540	51.0	35.9	15.1
550	54.7	35.0	19.7
560	47.3	32.2	15.1
0710	43.2	25.2	18.0
720	43.5	22.6	20.9
730	38.5	20.7	17.8
0810	43.2	24.6	18.6
820	45.7	23.8	21.9
830	35.7	22.8	12.9
West J.P.	47.3	28.6	18.7
Riverbend	34.9	24.0	10.9
Kaskitayo	40.5	26.0	14.5
Mill Woods	50.7	31.0	19.7
Hermitage	77.0	43.8	33.2
Castle Downs	55.7	40	15.7
0860	33.2	19.1	14.1
870	33.2	19.3	13.9
880	37.0	20.5	16.5
0910	49.3	22.8	26.5
920	46.0	23.9	22.1
930	42.0	24.2	17.8
940	45.0	24.7	20.3
950			
960	48.0	24.3	23.7
1010	43.0	26.6	16.4
1020	39.7	24.6	15.1
1031	40.0	23.6	16.4
1032	47.0	22.6	24.4
1041	34.0	23.9	10.1
1042	46.0	24.3	21.7
1110	42.0	26.0	16.0
1120	49.0	30.0	19.0
1130	42.0	26.4	15.6
1140	46.0	29.5	16.5
1150	47.9	27.0	20.9
1160	48.4	22.8	25.6
1170	46.9	24.6	22.3
1180			
1210			
1220			
1310	51.0	33.1	17.9
1320	49.2	31.6	17.6
1330	52.2	36.3	15.9
1340	56.3	36.1	20.2
1410	53.0	36.9	16.1
1421	58.4	39.2	19.2
1431	60.4	38.4	22.0
1440	66.1	41.8	24.3

TABLE IV-1 - (Cont'd.)

METS ZONE	BUS TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE	METS ZONE	BUS TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE
1520	66.4	39.8	26.6	2410	25.4	20.5	4.9
1540	60.9	38.5	22.4	2420	27.9	22.2	5.7
1550	71.0	36.0	35.0	2430	33.8	25.4	8.4
1610	66.0	37.3	28.7	2440	42.2	27.1	15.1
1620	64.2	38.8	25.4	2450	38.4	23.3	15.1
1630	62.8	39.4	23.4	2460	45.7	24.6	21.1
1710	63.0	39.0	24.0	2470	40.1	23.1	17.0
4133	65.2	37.1	28.1	2510	52.3	25.2	27.1
1910	70.0	40.1	29.9	2520	38.1	26.4	11.7
1920	67.0	40.0	27.0	2530	38.2	26.1	12.1
1930	71.0	40.7	30.3	2540	32.1	24.8	7.3
1940	71.0	42.8	28.2	2610	43.5	28.6	14.9
1950	67.0	41.0	26.0	2620	39.3	26.1	13.2
1960	70.0	41.1	28.9	2630	61.1	32.9	28.2
4120	60.0	39.8	20.2	2640	55.8	31.5	24.3
2010	15.4	13.2	2.2	2710	53.9	31.3	22.6
2020	8.1	9.9	--	2720	47.3	29.4	17.9
2110	23.7	18.9	4.8	2730	41.2	28.1	13.1
2120	35.8	18.7	17.1	2810	39.3	24.0	15.3
2130	42.2	23.3	18.9	2820			
2140	26.5	22.0	4.5	2910	43.5	22.7	20.8
2210	8.1	9.9	--	2920	39.8	22.0	17.8
2220	9.9	9.3	0.6	2960	42.6	22.2	20.4
2230	16.5	12.4	4.1	3010	24.0	18.5	5.5
2250	23.2	17.7	5.5	3021	28.3	19.2	9.1
2310	16.4	13.2	3.2	3022	36.1	23.0	13.1
2320	21.2	15.8	5.4	3030	26.7	18.6	8.1
2330	19.8	15.8	4.0	3040	40.5	23.0	17.5
2340	19.9	17.0	2.9	3050	34.9	23.2	11.7
2350	35.7	20.6	15.1	4250	60.0	40.6	19.4
2360	41.5	21.2	20.3				
2370	25.6	19.6	6.0				

1966 city transit travel times (1), adjusted to a portal to portal basis (Ref. Section 3.2), in comparison to 1970/1971 yielded a portal to portal transit travel time worsening averaging 6 minutes. The strategy argument, therefore, is that if one set of north side transit improvements to U of A can more than offset the travel time deterioration which occurred over five years, it is possible, through further future changes, to keep portal to portal transit travel time much the same as 1972/1973 by 1981/1982. Automobile travel, which is not tied to specific bus routes, does not have this flexibility and is projected in this study to get worse relative to transit by 1981/1982. The method used here gives top priority to the accuracy of the bus minus car travel time differences for curve use, notwithstanding having taken the utmost care to try and project actual travel times. The above assumption regarding transit travel time implies saving or finding an additional 7 minutes on both the north and south sides of Edmonton, or only half as much again as has been found in north side Edmonton transit service already in 1972. In this regard, further exploitation of direct and express bus service to U of A is possible as is creation of exclusive bus lanes or bus actuated traffic signals, through congested areas, such as are nearly available now on campus. It is generally known at this time that the city transit planners have already begun bus routing investigations on Edmonton's south side, which will eventually lead to the type of beneficial changes already witnessed in north Edmonton, further substantiating the above argument.

Continuing with automobile travel time considerations, a close examination of Associated's (1) 20 minute travel time contour, adjusted to a portal to portal basis (Ref. Section 3.2), yielded a 2.5 to 3.0

minute travel time worsening from 1966 to 1970/1971. On this basis FIGURE 4.1 sets out a modest or conservative estimate of the basis for automobile travel time worsening to 1981/1982, performed in keeping with a contour and/or time-distance from U of A basis. Unlike continued bus service to 89 Avenue inside the campus, the campus plan (15) envisages removal of parking from the heart of the campus to the periphery, which in itself will increase portal to portal automobile travel time, through more walking to campus buildings and increased cross campus automobile impedance (i.e. closure of 89 Avenue). With FIGURE 4.1 as reference, there remained but to summarize portal to portal automobile travel times for 1981/1982 to estimate the bus minus car travel time differences, all found on TABLE IV-1.

At this point the following question should be considered. If a bus service to the campus from 1966 to 1971 worsened 6 minutes compared to a worsening of only 3 minutes by car, how can the reverse type situation occur in the future? The answer to this question is very simple in that no recent planning oriented attention was given to bus service specifically to U of A until after the first joint City/University bus study (10) of November, 1970, and subsequent studies (11). Thus it was not until this time that the full current potentialities of the bus system to U of A were fully recognized and harnessed. The six minutes mentioned above has, through good planning, already been turned back in many city areas.

The next step in the future travel time estimations was to prepare TABLE IV-2, depicting the walk minus car travel time differences to 1981/1982, done assuming portal to portal walking time will remain constant throughout the campus walking zone to 1981/1982. Further, the campus walking zone (Ref. FIGURE 3.5) will not change.

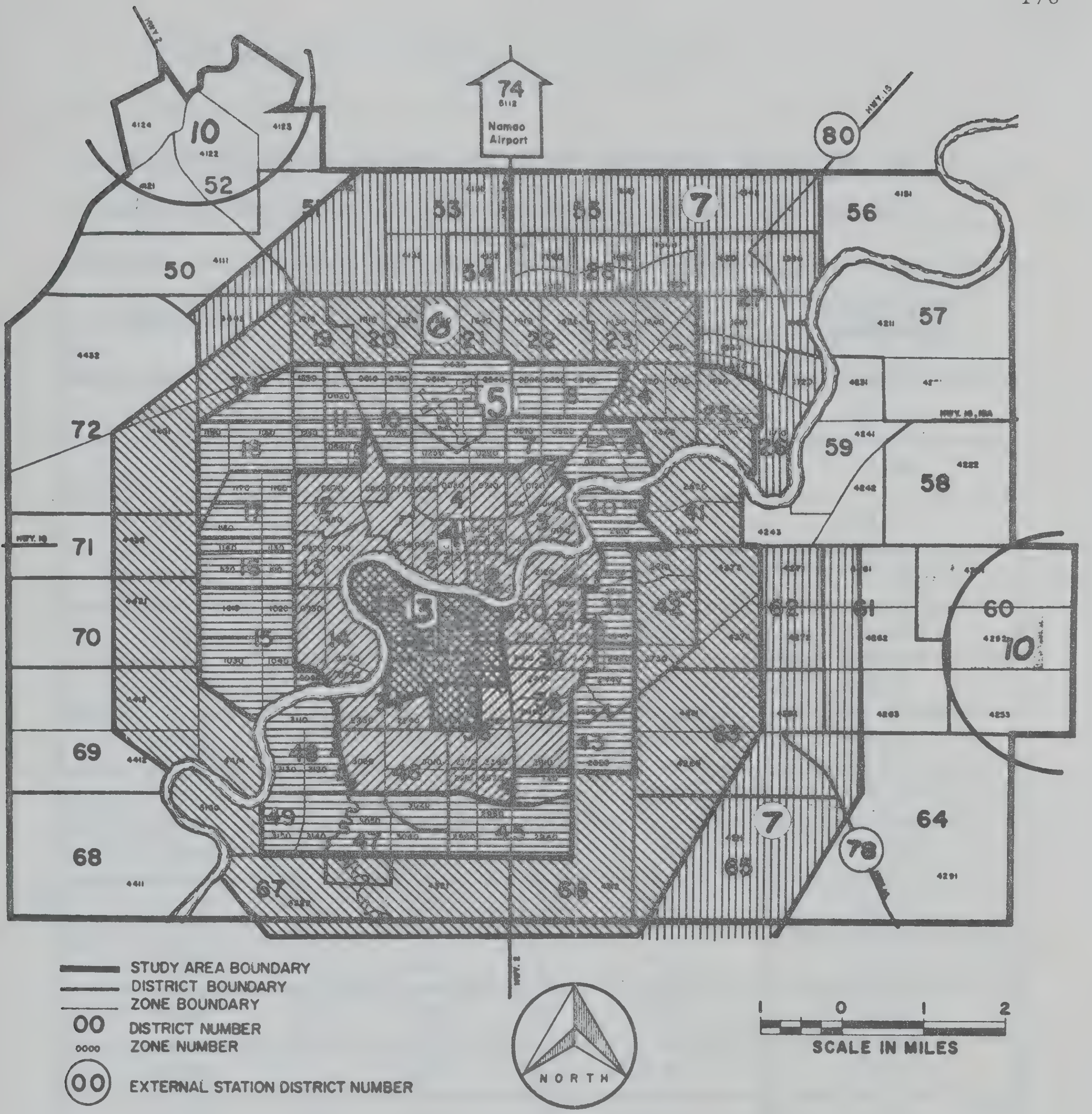


FIGURE 4.1. ESTIMATED INCREASES IN PORTAL TO PORTAL AUTOMOBILE TRAVEL TIME TO U OF A EDMONTON FROM 1971 to 1981 (Minutes)

TABLE IV-2

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982 WALK MINUS CAR PORTAL TO PORTAL TRAVEL TIME DIFFERENCES BY METS ZONE (Minutes)

METS ZONE	WALK TRAVEL TIME	CAR TRAVEL TIME	TRAVEL TIME DIFFERENCE
0050	32	16.8	15.2
0060	26	19.0	7.0
0070	34	18.8	15.2
0310	28	17.9	10.1
0320	35	17.6	17.4
0330	44	18.1	25.9
0340	49	17.8	31.2
2010	20	13.2	6.8
2020	15	9.9	5.1
2110	37	18.9	18.1
2210	11	9.9	1.1
2220	14	9.3	4.7
2230	30	12.4	17.6
2310	23	13.2	9.8
2320	33	15.8	17.2
2330	37	15.8	21.2
2340	44	17.0	27.0
2350	49	20.6	28.4
2410	44	20.5	23.5

Finally, the last item in the development of future travel times to be considered was the time zones of effectiveness of the proposed Edmonton Rapid Transit System (13), for bus and ride, and park and ride, and kiss and ride linked to Rapid Transit Service. Note that kiss and ride is defined as the dropping off of a transit patron from a car (vehicle other than bus) which then leaves the transit station, often being a wife dropping off a husband (or vice versa) and hence the expression kiss and ride. The time zones of effectiveness were developed as follows.

First for kiss and ride, and park and ride service, for both north side and south side Edmonton, a time-distance take-off was performed on the 1970/1971 portal to portal automobile travel times finding one inch to be worth 2.70 and 2.34 minutes respectively, at a city plan scale of 1 inch equals 2,000 feet. These factors were then used to test each METS zone along the potential equal time contour, or zone of rapid transit effectiveness boundary, as follows. For a given METS zone the distance in inches from zone centroid to the closest rapid transit station (13) was multiplied by the above time factors and this time added to the rapid transit travel time (Ref. APPENDIX III). In addition to this an estimated 4 to 5 minutes must be added to cover the increased walk from "University" (13) station to the campus centroid. Also, one to two minutes of walking time or parking time at rapid transit stations should be included and thus a total of five minutes additional travel time will be used. The study notes the De Leuw Cather rapid transit times (13) include waiting time at stations. The above time calculation is then simply compared to the all car mode use to U of A and if found less, indicates that rapid transit provides a time

advantage and will be within the zone of effectiveness. A sample calculation is shown for clarity.

METS Zone 0440 to Stadium Station (13)

By park and ride or kiss and ride to rapid transit; travel time

= 4.5 inches x 2.7 min/inch + 10.0 + 5.0 = 27.1 minutes.

By automobile to U of A estimated portal to portal travel time

= 34.4 minutes.

(Ref. TABLE IV-1).

Conclusion: 27.1 is less than 34.4 minutes and thus METS Zone 0440 is within the rapid transit to automobile effectiveness zone.

Finally, for bus and ride, the exact same approach as for car to rapid transit use was employed to ascertain the zone of rapid transit effectiveness. In this case, however, an inch of distance was found to be worth 4.82 minutes and 4.70 minutes in north side and south side Edmonton respectively. Again, an estimated five minutes must be added to rapid transit travel times for the same reasons as for automobile use above. A sample calculation is shown for clarity.

METS Zone 0720 to 107 Avenue Station (13)

By bus to rapid transit; travel time

= 2.75 inches x 4.82 + 16.0 + 5.0 = 34.3 minutes.

By bus to U of A estimated portal to portal travel time

= 43.5 minutes (Ref. TABLE IV-1).

Conclusion: METS zone is within the zone of bus to rapid transit effectiveness.

Two points about the proposed south side rapid transit should be made. First, the assumption of a "Southgate" station (13) puts Mill Woods (7) into the zone of effectiveness of car and bus to rapid transit. Second, on the basis of relative travel times, let alone socioeconomic considerations, half of Riverbend (8) will be outside of the rapid transit effectiveness zones. Throughout the rapid transit portion of the study the traffic principal has been followed that, generally, people will only travel towards, and will not back-track from, their destination to reach a rapid transit station.

In conclusion, FIGURE 4.2, which follows, summarizes the zones of effectiveness of rapid transit upon which subsequent analyses are based.

4.3. Estimated 1981/1982 Mode Split Without Rapid Transit Available

From TABLE IV-1 the estimated 1981/1982 bus minus car travel time differences were arranged by METS zones into five minute time interval categories shown on FIGURE 4.3. Then, on the basis of FIGURE 4.3 and TABLE II-26, showing the summary of the total population projection per METS Edmonton zones, TABLE IV-3 was developed to facilitate the mode split estimation. In this regard the less than ten minute travel time difference zone was treated differently than the overall table by identifying areas close in to The University of Alberta where student walking takes precedence over bus. In this particular case the student bus mode split, marked high on TABLE IV-3, becomes the remainder after the walking and drop-off mode students, plus an estimated 200 other students have been subtracted from the available students. Staff bus mode split is simply read off the study curves (Ref. FIGURE 3.8). The strong influence of walk and bus, in the first portion of the less than

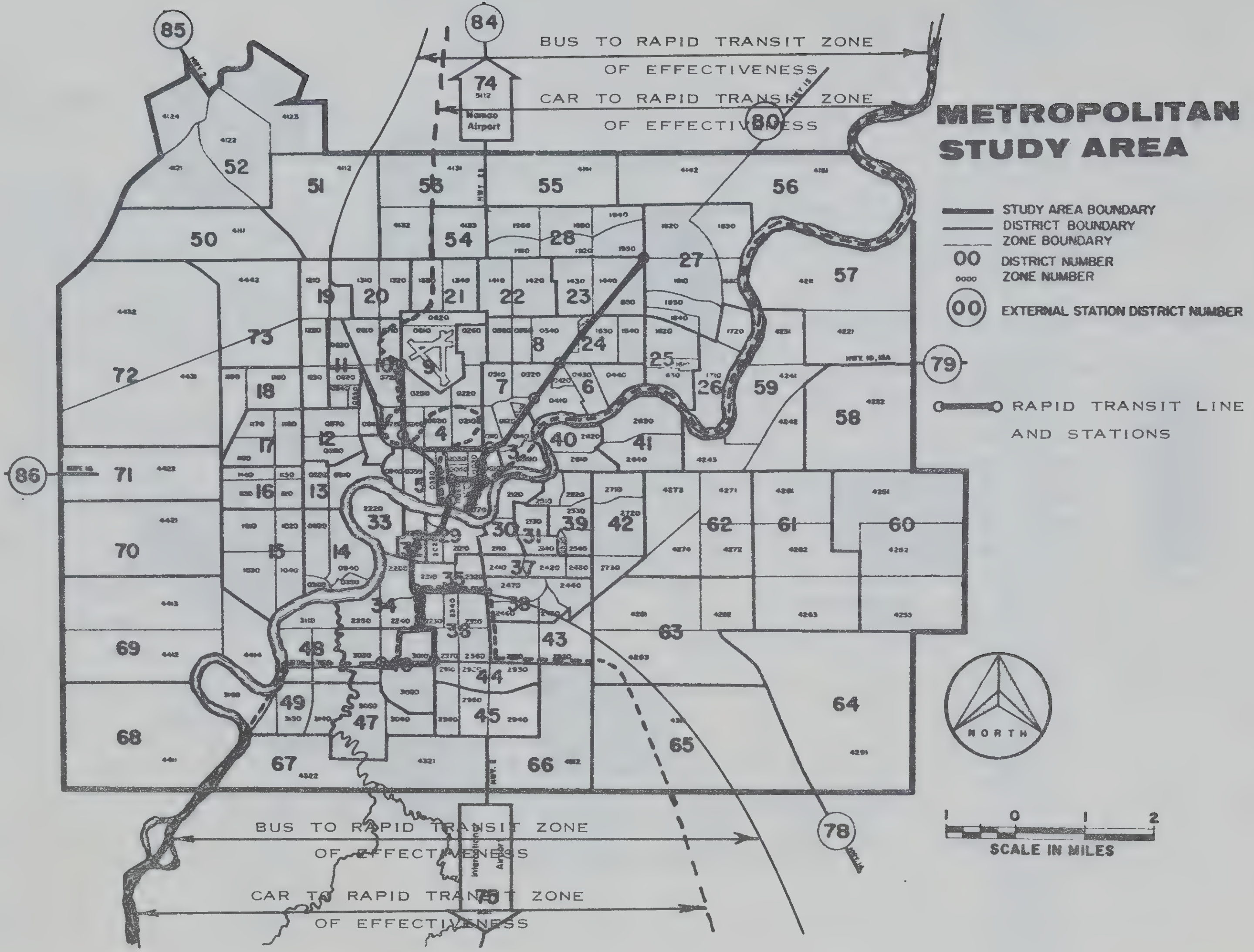


FIGURE 4.2. PROPOSED EDMONTON RAPID TRANSIT SYSTEM ESTIMATED ZONE OF EFFECTIVENESS FOR BUS AND RIDE AND PARK AND RIDE TO U OF A

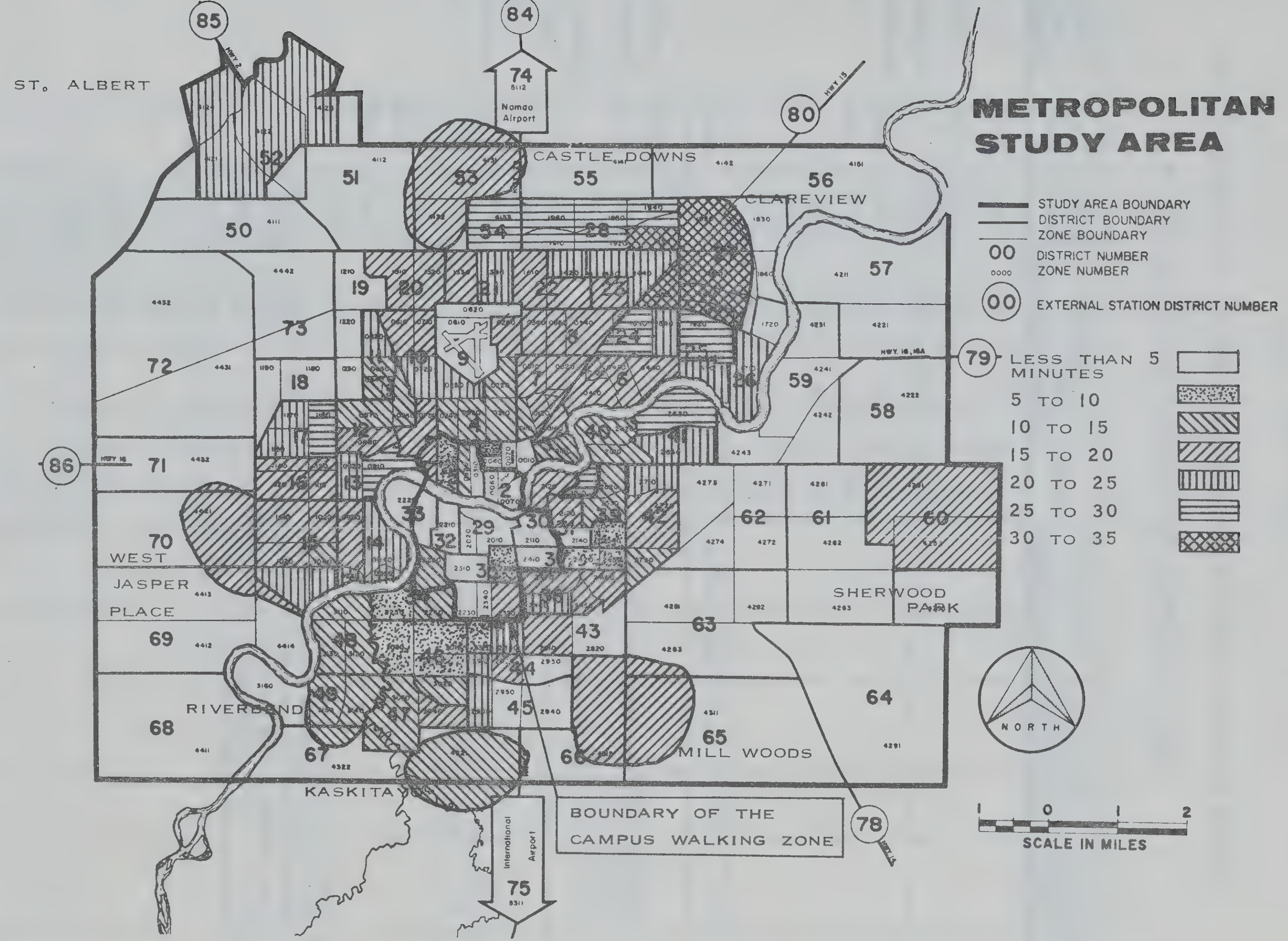


FIGURE 4.3. THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982 BUS MINUS CAR PORTAL TO PORTAL TRAVEL TIME DIFFERENCE ZONES

TABLE IV-3

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982 BUS MODE SPLIT BY BUS MINUS CAR TRAVEL TIME DIFFERENCE ZONES

Travel Time Difference	City Sector	METS Zone	Students		Staff	Total People		% Mode Use (Curves)		No. of People Using Bus Mode	
			Resident	Non-Resident		Student	Staff	Student	Staff	Student	Staff
Less than 10 minutes A. Walking Precedence Area	North Side	0050	293	23	66						
		0070	100	21	18						
		0310	161	16	40						
	South Side	2010	834	190	330						
		2020	270	639	254						
		2210	663	1,912	70						
		2220	120	68	122						
		2310	374	255	90						
	TOTAL					5,939	990	High	23.5	530	233
Less than 10 minutes B. Balance of Travel Time Difference Zone	North Side	0010	20	7	20						
		0020	12	-	-						
		0030	3	-	-						
		0040	15	5	10						
		0060	74	8	4						
		0030	312	4	97						
	TOTAL					460	131	70	23.5	322	31
	South Side	2110	541	95	216						
		2140	70	15	28						
		2250	324	6	75						
		2320	285	43	118						
		2330	200	44	69						
		2340	226	53	43						
		2370	258	13	120						
		2410	116	5	87						
		2420	102	11	31						
		2430	142	6	32						
		2540	82	6	41						
		3010	146	20	94						
		3021	383	-	150						
		3030	97	-	210						
	TOTAL					3,289	1,314	70	23.5	2,302	309

NOTE: METS zones enclosed like this are within the bus to rapid transit zones of effectiveness used in later calculations.

NOTE: People enclosed like this are in METS zones within the car to rapid transit zones of effectiveness used in later calculations.

TABLE IV-3 - (Cont'd.)

Travel Time Difference	City Sector	METS Zone	Students		Staff	Total People		% Mode Use (Curves)		No. of People Using Bus Mode	
			Resident	Non-Resident		Student	Staff	Student	Staff	Student	Staff
10 to 15 minutes	North Side	0110	54	4	5						
		0150	44	4	3						
		0210	459	5	83						
		0220	37	7	18						
		0230	461	5	95						
		0240	42	-	5						
		0320	390	4	131						
		0830	70	8	13						
		0840	4	4	-						
		0850	-	-	-						
		0860	301	16	60						
		0870	190	5	67						
		0880	130	7	54						
		1041	131	1	15						
	TOTAL					2,383	549	56	21	1,335	115
	South Side	2230	325	138	161						
		2520	126	9	36						
		2530	180	7	71						
		2610	97	6	12						
		2620	111	9	22						
		2730	28	-	34						
		3022	174	-	277						
		3050	144	1	135						
		Kaskitayo	304	-	238						
		Riverbend	1,169	8	237						
	TOTAL					2,836	1,223	56	21	1,588	257

TABLE IV-3 - (Cont'd.)

Travel Time Difference	City Sector	METS Zone	Students		Staff	Total People		% Mode Use (Curves)		No. of People Using Bus Mode	
			Resident	Non-Resident		Student	Staff	Student	Staff	Student	Staff
15 to 20 minutes	North Side	0120	72	7	10						
		0140	32	6	4						
		0260	368	3	54						
		0340	164	4	34						
		0410	112	8	40						
		0430	134	6	6						
		0440	191	6	22						
		0510	50	7	30						
		0520	35	5	3						
		0540	55	4	25						
		0550	34	1	21						
		0560	39	6	10						
		0710	29	3	16						
		0730	415	4	56						
		0810	85	6	31						
		0930	322	6	84						
		1010	451	6	86						
		1020	258	1	22						
		1031	136	1	87						
		West J.P.	339	-	149						
		1110	53	1	24						
		1120	86	1	33						
		1130	25	2	6						
		1140	13	1	18						
		1310	167	6	35						
		1320	105	4	23						
		1330	106	3	19						
		Castle-downs	152	-	279						
		1410	129	4	13						
		1421	112	5	37						
	TOTAL					4,390	1,277	50	20	2,195	255

TABLE IV-3 - (Cont'd.)

Travel Time Difference	City Sector	METS Zone	Students		Staff	Total People		% Mode Use (Curves)		No. of People Using Bus Mode	
			Resident	Non-Resident		Student	Staff	Student	Staff	Student	Staff
15 to 20 minutes continued	South Side	2120	20	14	20						
		2130	91	9	31						
		2350	135	22	21						
		2440	132	4	18						
		2450	41	3	5						
		2470	138	5	76						
		2720	234	12	120						
		2810	5	1	2						
		2920	9	4	5						
		Mill Woods	375	-	488						
		3040	95	-	276						
		Sherwood Park	469	1	257						
	TOTAL					1,820	1,319	50	20	910	264
20 to 25 minutes	North Side	0250	34	3	8						
		0720	378	6	35						
		0820	80	6	9						
		0920	149	3	15						
		0940	355	4	76						
		0950	-	-	-						
		0960	7	-	4						
		1032	91	1	43						
		1042	88	1	7						
		1150	70	2	18						
		1170	68	1	4						
		St. Albert	713	2	119						
		1340	150	3	76						
		1431	114	5	38						
		1440	41	5	12						
		1540	36	2	6						
		1630	97	2	24						
		1710	79	-	11						
	TOTAL					2,596	505	47	20	1,220	101

TABLE IV-3 - (Cont'd.)

Travel Time Difference	City Sector	METS Zone	Students		Staff	Total People		% Mode Use (Curves)		No. of People Using Bus Mode	
			Resident	Non-Resident		Student	Staff	Student	Staff	Student	Staff
20 to 25 minutes continued	South Side	2360	89	9	24						
		2460	115	5	16						
		2640	290	9	54						
		2710	88	7	24						
		2910	38	4	12						
		2960	39	5	44						
	TOTAL					698	174	47	20	328	35
25 to 30 minutes	North Side	0910	100	9	24						
		1160	68	2	56						
		4133	32	-	-						
		1520	35	2	9						
		1610	14	3	3						
		1620	64	4	6						
		1910	49	-	31						
		1920	76	-	18						
		1940	105	5	10						
		1950	93	4	22						
		1960	120	-	27						
	TOTAL					785	206	45	20	353	41
	South Side	2510	90	6	21						
		2630	299	5	34						
	TOTAL					400	55	45	20	180	11
30 to 35 minutes	North Side	1550	-	-	6						
		1930	105	-	27						
		Clareview Hermitage	226	-	214						
	TOTAL					331	247	44	20	146	49
Commuters Greater than 35 minutes	North		48	5	4						
	South		90	10	20						
	East		69	5	104						
	West		42	4	61						
	TOTAL					273	189	35	15	96	28
TOTAL PEOPLE			22,141	4,059	8,179	34,379				11,505	1,729

10 minute bus minus car travel time difference zone, precludes any general use of student automobiles and the car pool mode in 1981/1982. Regarding TABLE IV-3, bus minus car travel time difference zones have been grouped according to north and south side Edmonton areas to make the information immediately useful to City transportation planners. The next step in the development of TABLE IV-3 was to consult the 1970/1971 student and staff bus minus car travel time difference mode split curves, FIGURES 3.7 and 3.8, from which were extracted the appropriate bus usage percentages. Upon so doing, the final step was to multiply out both students and staff, on TABLE IV-3, by the relevant bus use percentages to arrive at the total of 11,505 students and 1,729 staff bus users estimated for 1981/1982.

The next step in the overall mode split determination was to perform the walking mode split which was done as follows. First, on the basis of TABLE IV-2, METS zones of like walk minus car portal to portal travel time differences were grouped into five minute zones on TABLE IV-4. Again, as in the previous bus minus car mode split determination, the relevant predicted student and staff numbers were obtained per METS zone from TABLE II-26. Then the 1970/1971 student and staff walk minus car travel time difference mode split curves, FIGURES 3.7 and 3.8, were consulted from which the appropriate walk percentages were transferred to TABLE IV-4. The final step was to then multiply out the students and staff by the correct walking percentages to arrive at the estimated totals of 6,226 student and 760 staff walkers in 1981/1982.

At this point in the mode split development only modes using automobile, which involve the vast majority of the remaining campus

TABLE IV-4

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982 WALK MODE SPLIT BY WALK MINUS CAR TRAVEL TIME DIFFERENCE ZONES

TRAVEL TIME DIFFERENCE	CITY SECTOR	METS ZONE	STUDENTS		TOTAL STUDENT	STAFF	% MODE USE (CURVES)		NO. OF PEOPLE USING WALK MODE	
			RESIDENT	NON-RESIDENT			STUDENT	STAFF	STUDENT	STAFF
Less than 10 minutes	South Side	2010	834	190	1,024	330	80.0	57.0	819	188
		2020	270	639	909	254	87.0	66.0	791	168
		2210	663	1,912	2,575	70	100.0	83.0	2,575	58
		2220	120	68	188	122	88.0	68.0	165	83
		2310	374	355	729	90	70.0	47.0	510	42
10 to 15 minutes	North Side	0310	161	16	177	40	69.0	46.0	122	18
15 to 20 minutes	North Side	0050	293	23	316	66	52.0	28.0	164	19
		0060	74	8	82	4	45.0	24.0	37	1
		0070	100	21	121	18	52.0	28.0	63	5
		0320	390	4	394	131	43.0	23.0	169	30
	South Side	2110	541	95	636	216	41.0	22.0	261	48
		2230	325	138	463	161	42.0	23.0	195	37
		2320	285	43	328	118	44.0	23.0	144	27
20 to 25 Minutes	South Side	2330	200	44	244	69	29.0	15.0	71	11
		2410	116	5	121	87	23.0	12.0	28	10
25 to 30 Minutes	North Side	0330	312	4	316	97	17.0	9.0	54	9
	South Side	2340	226	53	279	43	13.0	8.0	36	4
		2350	135	22	157	21	9.0	6.0	14	1
30 to 35 minutes	North Side	0340	164	4	168	34	5.0	3.0	8	1
								Total People	6,226	760

population, and the mode other need accounting for. This was done as follows.

From TABLES III-2 and III-3,which show historic mode split trends for students and staff at U of A, it was seen that the mode other is slowly approaching 2%, being an amount that was used for the 1981/1982 mode split. In essence,the new wave of bicycle use of the last couple of years has very likely started to level off whereas hitchhiking amongst students has only limited use, being risky and uncomfortable in a cold climate. Also,the mode walk, offers many of the health and cost advantages of the mode other, and growth in this area has already been demonstrated.

Again referring to TABLE III-2 and the historic record of car pooling, it is probable that the student use of this mode will continue to adhere to the 6% mode split area experienced consistently over five years. Naturally,this issue is subject to campus automobile policy considerations, recognizing that the real problem in student car pool formation is the wide variance in the time of attending lectures, and varied study habits in relation to family responsibilities and part-time jobs. Thus the 6% figure is used as a reasonable mode split in the future, and of course implies slightly more car pooling as the campus student population grows.

Staff car pooling on the other hand is often much more practical because of the regularity of working hours, particularly for non-academic staff. As such, and in keeping with actual university experience as shown on TABLE III-3, this staff mode is expected to grow to approximately 12% by 1981/1982. The reader will note that the estimated

growth rate is conservative in relation to the 3.6% growth in the staff car pool mode that was experienced from 1965/1966 to 1966/1967 (Ref. TABLE III-3).

Again referring to TABLE III-2, student drop-off was projected to decline to 4%. The reason for this is that it appears that increased traffic congestion on the south side of Edmonton, in addition to that of river crossings, is making the mode increasingly unattractive in relation to a vastly improved bus service. For similar reasons staff drop-off is projected to decline to the 5% level, which of course is still significant.

Having thus estimated the mode splits, bus, walk, other, car pool and drop-off for students and staff, there remained but to add them all up and subtract them from the appropriate 1981/1982 student and staff population projections to obtain the automobile driver mode. TABLE IV-5 summarizes the 1981/1982 University of Alberta mode split assuming no rapid transit.

4.4. Estimated 1981/1982 Mode Split with Rapid Transit Available

4.4.1. Technical Considerations

The introduction of a new arterial road or freeway, or transportation facility (new mode of travel), into an urban area provides the opportunity for travellers to divert from their previous route or travel mode to the new facility. This diversion of people's trips to a new travel facility is quite obviously related to the transportation benefits they receive or experience in going from their origins to their destinations (portal to portal trip) via the new way, and is fundamentally a matter of the determinants of choice of travel mode. Thus, in the case

TABLE IV-5

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982 TRANSPORTATION MODE SPLIT ASSUMING NO RAPID TRANSIT

TRAVEL MODE	STUDENT	STAFF	TOTAL USERS
Auto Driver	5325	4135	9460
Car Pool	1572	982	2554
Drop-off	1048	409	1457
Bus	11505	1729	13234
Walk	6226	760	6986
Other	524	164	688
Total People	26200	8179	34379

of the proposed Edmonton Rapid Transit System (13), use of the system by university bound transit patrons would constitute a diversion of trips away from other present travel modes, other things remaining equal.

Furthermore, the diversion of trips to rapid transit would range from full use of rapid transit, to use of bus coupled with rapid transit, to park and ride, and kiss and ride, to walk coupled with rapid transit. In summary, however, the majority of university bound trip movements within the rapid transit zones of effectiveness (Ref. FIGURE 4.2) would become essentially a choice involving the major use of public transit, private automobiles, walking, or combinations thereof.

With regard to factors determining the choice of travel mode, Hill and Von Cube (30) suggest five basic factors for consideration as follows:

1. Relative travel time via public transit and private automobile.
2. Relative travel cost via public transit and private automobile.
3. Relative excess travel time via public transit and private automobiles. (Also known as relative level of service or convenience. Excess time is defined as the time spent outside a vehicle while en route. In this regard portal to portal travel time from origin to destination is the overall travel time being considered.)
4. Economic status of trip makers. (Income per worker.)
5. Trip purpose.

Additionally, Hill and Von Cube (30) suggest that many other possible determinants to mode choice such as trip length, population

density, employment density, transit seat capacity, and other factors, were all found to be linearly dependent on at least one of the four determinants, time, cost, service, and income, enumerated above.

With regard to what The University of Alberta transportation situation would be with the use of the proposed Edmonton Rapid Transit System (13), the five basic determinants to travel mode choice, above, would have to be expanded to cover all the combinations of the major modes involving the use of automobiles, buses, rapid transit and walk, by university people.

And upon logical and systematic application and evaluation of the five basic determinants governing travel mode choice, in all the necessary combinations covering the future University of Alberta transportation situation, the home to work trips diverted to rapid transit could be identified. Such an origin destination type analysis would indeed provide the required University of Alberta mode split including the use of rapid transit.

Unfortunately, however, with respect to rapid transit (13) and the basic modal split factors, there are a sufficient number of unknowns at this time, such as factors and/or hard data on costs and services, so as to render scientific measurement of trip diversion to rapid transit impossible to perform. This project, therefore, must recognize this fact and proceed on the basis of noting the experience of other cities, thus performing a future university mode split assuming rapid transit diversion values thought to be reasonable. Because of the importance of rapid transit diversion to The University of Alberta and the City of Edmonton in regards to the success of the proposed Edmonton Rapid Transit

System (13), this study will forthwith suggest as to how transit diversion could be measured as soon as possible. Because of the nature of the five basic determinants to choice of travel mode, each major city will, in fact, have a significantly different or unique set of transit diversion curves to warrant their measurement in the case of justifying sizeable capital projects. This matter is handled further in the recommendations section of the report.

Concluding technical aspects of the diversion of home to work trips to transportation facilities, a 50% diversion of trips to new arterials or freeways has been widely documented (41). With regard to transit trip diversions, Hill and Von Cube (30) report values ranging from approximately 50% to 85% for a public transit to automobile travel time ratio of 1.0 or less. Their figures include Toronto, Canada, and thus experience with bus and rapid transit components to public transit. In view of their research findings, and because travel time ratio within the rapid transit zones of effectiveness for Edmonton (Ref. FIGURE 4.2) will be 1.0 and less according to plan, an 80% diversion to rapid transit of the bus and car, home to work trips to The University of Alberta appears to be attainable. This point of course assumes that rapid transit trips will be competitive in cost, and service standards, with alternative forms of transportation. Regarding insight into the 80% trip diversion assumption, FIGURE 3.4, covering student diversions to transit outside the campus walking area, clearly shows that diversions of 60%, for a travel time ratio of 1.50, have already been experienced by The University of Alberta as early as 1970/1971. Furthermore, the five year campus transportation trend has been largely in the favor of increased public transit use. Thus an 80% diversion of student home to work trips

to rapid transit, within the zones of effectiveness (Ref. FIGURE 4.2), appears very reasonable. Where the 80% diversion assumption definitely touches on absolute maximum is with university staff, being particularly those academic staff who will be located in the south side Edmonton rapid transit zone of effectiveness (Ref. FIGURE 4.2) in areas of higher socio-economic status (Ref. FIGURE 2.11).

Again, however, Hill and Von Cube (30) report that high income is not necessarily a deterrent to transit use provided that time, cost, and convenience of service are competitive with portal to portal trips by automobile. Thus an 80% diversion may be attainable.

4.4.2. Proposed Transit Work Trip Diversion Study

Because there is an urgent need to know what transit diversions are in fact possible for a superior type of mass transit service not greatly unlike rapid transit (13) for the City of Edmonton, the following study is hereby suggested. The conceptualization of this study has been kept purposely simple, yet adequate, in order that data collection and analyses can be greatly minimized, yet rigidly controlled for economic and timely reporting. Since the study does, in fact, suggest changed and/or possible additional transit service (i.e. possibly more rolling stock would be required), the suggestions to follow have been made to tie in with what are believed to be almost immediate University and City transit needs, as well as to longer term propositions.

In essence, the study suggests that two direct park and express bus ride services be commenced to The University of Alberta, being one from 45 Avenue and 122 Street (Lord Byron and Michener Park apartments) and one from St. Albert. With respect to the considered reasons for

this dual suggestion, the former origin is in the midst of the greatest residential densities of students and staff outside the campus walking area in a high socio-economic city area (Ref. FIGURE 2.11). Thus, if substantial new transit trip diversions were found in this location, similar trip diversions could be anticipated in lower socio-economic city areas. With the area already being serviced by bus the effects of a greatly improved transit service could accurately be measured. The university owns and manages Michener Park and excellent transportation survey control could be exercised. Further, the area is in the zone of effectiveness (Ref. FIGURE 4.2) of the proposed Edmonton Rapid Transit System (13) such that a more lasting transit service is actually possible.

As to reasons for the St. Albert express bus suggestion, again good densities of university students and staff are located there in a mature, yet rapidly growing town. Transit service from the town exists now but is not direct to The University of Alberta such that the effects of a new, swift, non-stop direct bus to U of A via the St. Albert Trail and Groat Road route could accurately be measured. Because the present (1970/1971) average portal to portal transit trip of 66.2 minutes (Ref. TABLE III-1) could be significantly reduced with direct non-stop express park and bus ride service, the proposed situation has very comparable travel time benefits to an in-city, future rapid transit situation. Further, St. Albert is generally a middle income socio-economic area (town - Ref. FIGURE 2.11) such that a different kind of transit trip diversion result than the Michener Park area could be anticipated. Again, as at Michener Park, St. Albert could well be a part of the proposed Edmonton Rapid Transit System some day (13, 4).

In short, the study envisages splitting the risk of decision making on the basis of studying transit trip diversions from only one city area by simultaneously studying two.

With regard to the transit service being suggested, in keeping with Hill and Von Cube's (30) five basic modal split determinants, the service must be fast, reliable, comfortable and convenient, and economic, etc. in relation to private automobile. Both at the St. Albert and 45 Avenue and 122 Street (suggest a transit loop on the southwest corner) transit stations, adequate parking and passenger drop-off bays would be required to minimize excess time. Simple transit shelter buildings, preferably housing a coffee, newspaper, snack and smoke concession would be required. Walking provisions to both termini should be given a top priority. With respect to the proposed route in from St. Albert, no travel time problem is foreseen, although the route should be planned to give the new bus advantages or priority over other general traffic if required. The proposed 45 Avenue and 122 Street (origin) bus service, however, will not have sufficient travel time advantage over car, on the 122 and 114 Streets route to The University of Alberta from the south, because of the frequent peak hour traffic back-ups along and just before 114 Street. Thus it is suggested that the new bus service cross onto 116 Street following Belgravia Ravine, thence north on 115 Street, west on the south side of University Avenue (on service road), north on 117 Street and west on 87 Avenue to The University of Alberta. In this way sufficient travel time could be saved to give the bus a distinct advantage over car travel, more closely resembling what rapid transit service is meant to be. With regards to the proposed new southern bus route, bus triggered traffic control devices (briefly timed traffic

lights called bus priority active systems) will be required at Belgravia Ravine and 116 Street and at the University Avenue - 117 Street crossings such that the bus vehicle only can travel across the traffic streams as a non-stop type of express bus service. Coincidentally, pedestrian and cyclists could be greatly assisted at these two precarious road crossings, particularly on University Avenue. In summary, both proposed new experimental park and bus ride express bus services must have continuous traffic surveillance to ensure the desired portal to portal travel time ratios in the vicinity of 1.0 and hence an accurate measure of superior transit trip diversion.

Regarding administration of the required before and after (introduction of the new bus services) origin-destination, and perceived, travel time studies, the following is proposed. Before the new transit services are even publicized, let alone commenced, all university people residing in METS Zones 2960, 3021, 3022, 3030, 3040, 3050, 3120 and 3130 plus St. Albert (Ref. FIGURE 4.2) should be identified from University records and mailed a self addressed return envelope type transportation questionnaire with the necessary questions (Ref. APPENDIX II), including identification of whether they are a student or staff by type of staff. Naturally, all required questions would be asked, including automobile ownerships, automobile availability and sex, etc., so that the proposed study is very scientific and complete in every regard on why people use public transit. By proper administration a relatively high return could be obtained and entered on machine records. Next, after introduction of the two proposed superior transit services, the same studies as before can be administered, except that a specific mode split question regarding the new service (plus park and ride, bus and ride, etc.) would

necessarily have to be added to clearly identify before and after transportation mode split. This would be done, of course, by a strict comparison of the before and after questionnaire responses of the same people. As shown in CHAPTER III of this thesis, high quality data can be anticipated from university people. Because, however, a new transit service takes a year or more to fully catch on with the public, a decision would have to be made regarding the timing of the second (and possibly third) transportation questionnaire administration. In the meantime the study group could in fact be performing transit patron counts and/or interviews on the actual proposed buses, and running simple travel time studies for interim as well as final reporting purposes. In this regard, although the study is for the measurement of mode split on the home to work trip movement it is evident that the late afternoon and evening work to home trip needs attention. In short, with trips in addition to work trips found on the Metropolitan Edmonton road system, travel time may be greater than in the A.M., such that the decision of people to use rapid transit might reflect partly upon the reverse trip, in spite of its presumed lower travel time urgency. In effect, this important aspect has never been studied in Edmonton yet it should be.

Finally, upon retrieval of all necessary before and after travel time and mode split data, the required public transit diversion curves could be plotted against travel time ratio (or travel time difference - whichever measure works best) and stratified as to income, most simply done as student, non-academic staff member, and academic staff member. In this regard, additional data could be acquired, if required, including Federal Census Income and demographic data etc. upon the neighbourhoods

and people in question.

In conclusion, the public transit study proposed above would in fact generate the necessary diversion curves for the City of Edmonton such that a scientific evaluation of trip diversion to the proposed Edmonton Rapid Transit System (13) could be assessed.

4.4.3. Mode Split Based Upon Assumed Diversion

In keeping with the previous transit trip diversion discussions, the purpose of this section of the study is to estimate the 1981/1982 U of A mode split assuming the availability and use of the proposed Edmonton Rapid Transit System (13). With the experience of Hill and Von Cube (30), and Schmidt (41), and this study (Ref. FIGURES 3.4, 3.7, and 3.8) duly noted, it appears that student and staff bus and car home to work trip diversions to rapid transit, where relevant (Ref. FIGURE 4.2), will range from 70% to 90% and 50% to 80% respectively. Because students will outnumber staff by more than three to one, and since only 45% of the estimated staff (Ref. TABLE IV-3) will be in the rapid transit effectiveness zones (Ref. FIGURE 4.2), the study hereby assumes an 80% diversion for the bus and car to rapid transit work to follow. With respect to the non-mechanized, free costing travel mode walking, a 70% diversion of home to work U of A trips to rapid transit is assumed and described in estimations to follow.

This portion of the study is largely a description of a geographic based diversion of university people to the use of rapid transit within the zones of effectiveness of the mode (Ref. FIGURE 4.2). In this regard, what actually takes place here is a rational translation of the no rapid transit mode split of TABLE IV-5, into a mode split

assuming the use of rapid transit (13) by The University of Alberta students and staff.

The first step in the development of the required mode splits was to identify the appropriate METS zones, complete with estimated future university populations, within the bus and car rapid transit zones of effectiveness. This was done in keeping with FIGURE 4.2 as shown on TABLE IV-3 whereon METS zones firstly, and students and staff secondly, are enclosed or set apart for bus and car to rapid transit calculations respectively. Next, from this table, and on the basis of an 80% diversion from bus to rapid transit within the bus to rapid transit zones of effectiveness, the continuing number and origin of bus riders was calculated as shown on TABLE IV-6.

TABLE IV-7 sets out the estimated diversion of the walking mode to rapid transit use. The number of walkers attracted to the rapid transit system will likely fluctuate with the seasons and temperature, in relation to the economics of the proposed line. As many walkers could now employ faster means of travel to U of A, obviously travel time is not the only major factor to the choice of the walking mode. Because of the location of the rapid transit line and proposed stations on Edmonton's south side (13), the greatest density of south side campus bound walkers will be unaffected by rapid transit. Based on these considerations it was estimated that on an eight month university winter session basis, of which generally only three to four months (December, January, February, March) are unsuitable for sustained or long distance walking, a 70% diversion of walkers to rapid transit in the relevant zones of TABLE IV-7 is indicated. The one exception to this estimate is

TABLE IV-6

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982
BUS MODE SPLIT ASSUMING RAPID TRANSIT AVAILABLE

BUS - CAR TRAVEL TIME DIFFERENCE ZONES	STUDENT	STAFF	TRAVEL TIME DIFFERENCE CURVE %		CONTINUED BUS USERS	
			STUDENT	STAFF	STUDENT	STAFF
LESS THAN 10 MINUTES						
A. Walking Precedence Area -N & S Combined	5797	958	HIGH	23.5	388	225
B. Balance of Travel Time Difference Zone						
-North Side	345	104	70	23.5	242	24
-South Side	2137	765	70	23.5	1496	180
10 to 15 MINUTES						
North Side	1485	382	56	21	832	80
South Side	1867	608	56	21	1046	128
15 to 20 MINUTES						
North Side	2382	690	50	20	1191	138
South Side	1303	687	50	20	652	137
20 to 25 MINUTES						
North Side	1763	329	47	20	829	66
South Side	455	97	47	20	214	19
25 to 30 MINUTES						
North Side	300	105	45	20	135	21
South Side	400	55	45	20	180	11
30 to 35 MINUTES						
North Side	66	48	44	20	29	10
South Side	N/A	N/A	N/A	N/A		
COMMUTERS GREATER THAN 35 MINUTES	151	170	35	15	53	26
TOTAL PEOPLE					7287	1065

TABLE IV-7

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982
WALK DIVERSION TO THE PROPOSED RAPID TRANSIT

METS ZONE	STUDENTS	STAFF	TOTAL
0050	115	13	128
0060	26	1	27
0070	44	4	48
0310	85	13	98
0320	118	21	139
0330	38	6	44
0340	6	1	7
2230	49	9	58
2310	128	11	139
2330	50	8	58
TOTAL PEOPLE	659	87	746
CONTINUED 1981/82 CAMPUS BOUND WALKERS	6226* -659 5567	760* -87 673	6240

* Ref. TABLE IV-4.

that METS Zones 2230 and 2310 (Ref. FIGURE 4.2), which are very close to campus, were given only a 25% diversion of walkers to rapid transit. The reasons for this are that people, generally, will travel only forwards, and not backtrack from their destination, to reach a rapid transit station. In addition, the two METS zones mentioned are within an easy walking distance from the campus. Thus one quarter of the land area of the zones was considered relevant to rapid transit.

As the bus and walk mode splits are the basis of the travel time difference method developed in this study, the estimations just used in getting mode splits were quite straightforward. Getting the proper mode split for the three modes involving the use of automobiles, however, calls for a special analysis performed as follows.

First, for students and staff in 1970/1971, which is the year of most current and best quality data, FIGURES 4.4 and 4.5 and TABLE IV-8 were developed showing the Edmonton METS zone origins for the automobile driver, car pool, drop-off, and other modes. As then indicated on FIGURES 4.4 and 4.5, the north side and south side Edmonton percentage split of automobile drivers was calculated, as was the percent found in the two rapid transit effectiveness zones (Ref. FIGURE 4.2). This procedure was followed throughout this portion of the study to recognize geographically differentiated city generations of the automobile oriented modes in question. TABLE IV-9 summarizes these results to be used in estimating the mode splits. The inherent assumption here is that the 1981/1982 city distribution of these modes will be generally the same as in 1970/1971. The final step, before proceeding into the actual mode split calculation, was to produce TABLE IV-10, to be used in

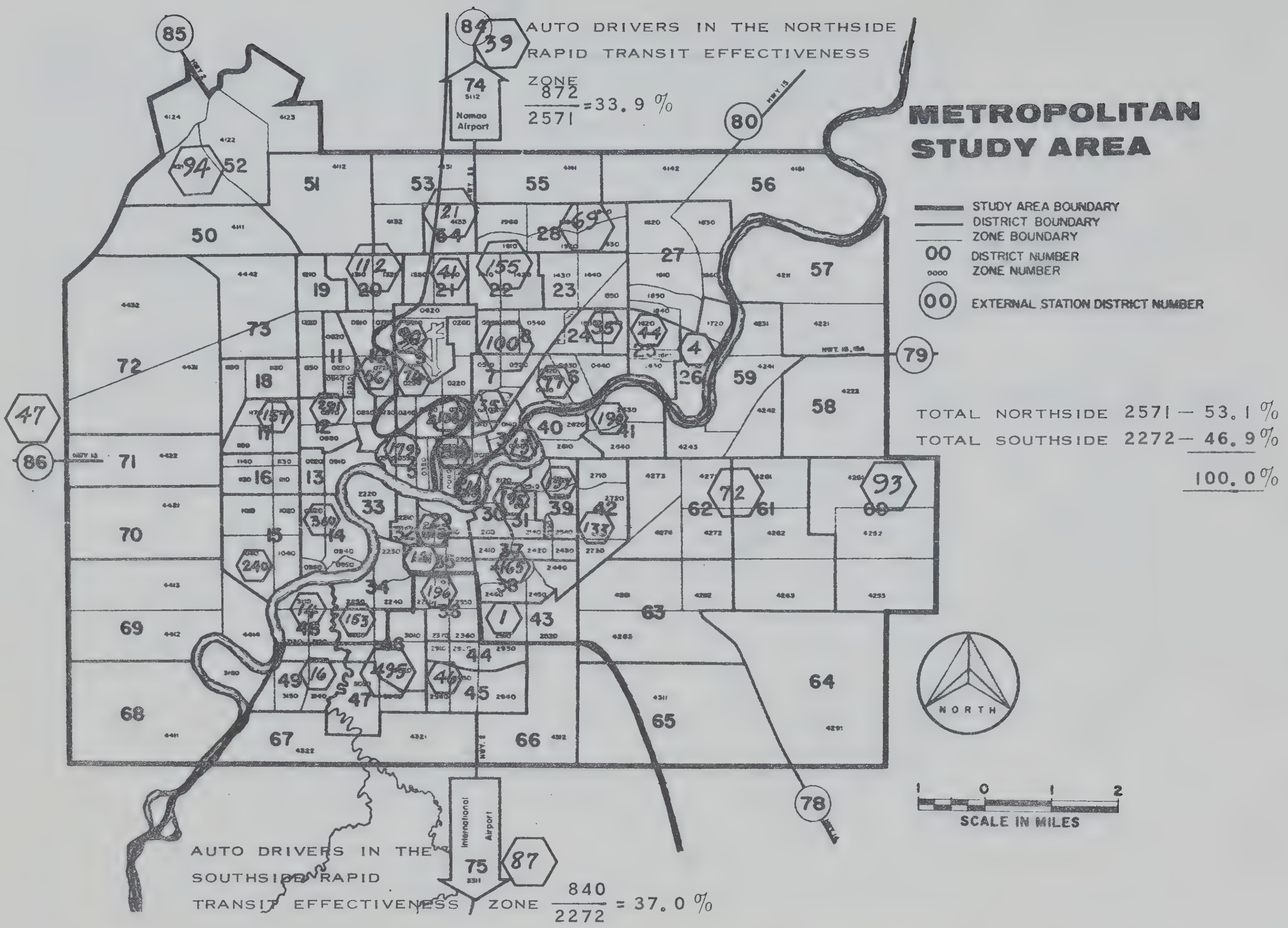


FIGURE 4.4. EDMONTON GEOGRAPHIC ORIGIN OF U OF A STUDENT AUTOMOBILE DRIVERS 1970/1971

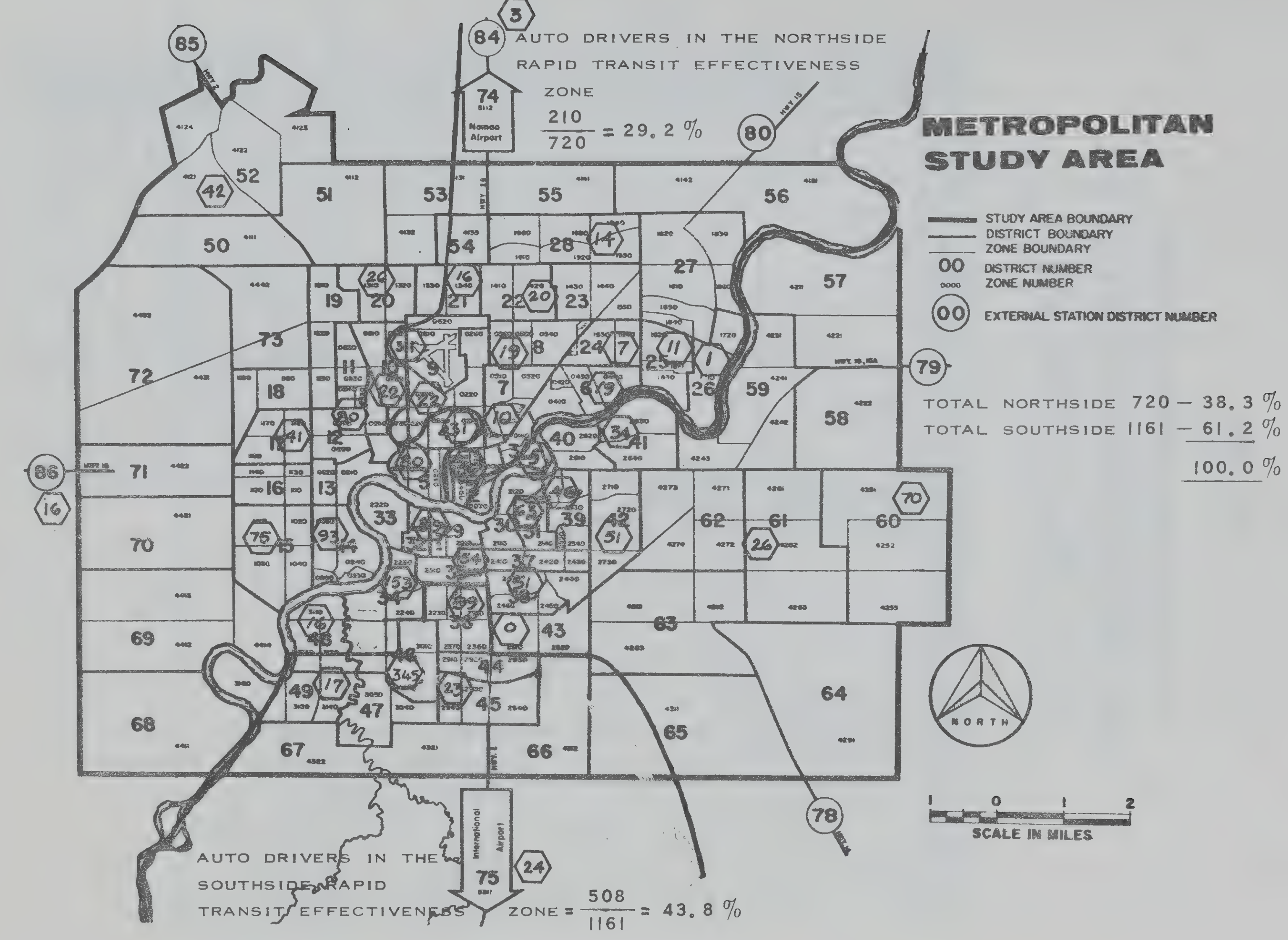

METROPOLITAN
STUDY AREA
STUDY AREA BOUNDARY
DISTRICT BOUNDARY
ZONE BOUNDARY
00 DISTRICT NUMBER
0000 ZONE NUMBER
(00) EXTERNAL STATION DISTRICT NUMBER
AUTO DRIVERS IN THE NORTHSIDE RAPID TRANSIT EFFECTIVENESS ZONE
210/720 = 29.2 %
AUTO DRIVERS IN THE SOUTHSIDE RAPID TRANSIT EFFECTIVENESS ZONE = 508/1161 = 43.8 %
TOTAL NORTHSIDE 720 — 38.3 %
TOTAL SOUTHSIDE 1161 — 61.2 %
100.0 %
Namao Airport
International Airport
NORTH
SCALE IN MILES
1
0
1
2
HWY 2
HWY 15
HWY 16
HWY 16, 16A
85
84
80
79
78
86
74
75

FIGURE 4.5. EDMONTON GEOGRAPHIC ORIGIN OF U OF A STAFF AUTOMOBILE DRIVERS 1970/1971

TABLE IV-8

SUMMARY OF EDMONTON GEOGRAPHIC ORIGINS OF THE U OF A STUDENT AND STAFF TRAVEL MODES CAR POOL, DROP-OFF, AND OTHER 1970/1971

METS	CAR POOL		DROP-OFF		OTHER		METS	CAR POOL		DROP-OFF		OTHER	
ZONES	STUDENT	STAFF	STUDENT	STAFF	STUDENT	STAFF	ZONES	STUDENT	STAFF	STUDENT	STAFF	STUDENT	STAFF
0010-0070	11	2	18	5	5	0	2010-2020	29	13	38	15	54	18
0110-0150	7	2	5	1	2	0	2110-2140	48	14	29	15	29	2
0210-0260	37	12	33	6	9	0	2210-2250	52	6	40	10	36	11
0310-0340	40	14	30	7	12	0	2310-2370	64	17	52	38	52	12
0410-0440	8	5	12	1	1	0	2410-2470	34	14	32	12	11	0
0510-0560	13	1	9	1	1	0	2510-2540	32	8	22	4	3	2
0710-0730	41	11	22	2	9	0	2610-2640	29	8	22	5	4	0
0810-0880	92	18	49	9	14	1	2710-2730	28	9	13	4	7	0
0910-0960	130	2	70	8	5	0	2910-2960	4	4	6	2	0	1
1010-1042	64	9	49	6	8	1	3010-3050	100	44	77	26	22	5
1110-1180	32	7	15	6	5	0	3110-3160	5	5	5	0	3	0
1310-1340	23	7	26	5	1	0	4250	24	13	26	3	1	0
1410-1440	14	0	21	1	1	0							
1520-1550	7	2	9	0	0	0							
1610-1630	13	1	2	0	0	0							
1710-1950	13	2	12	2	1	0							
4120	27	2	22	2	1	0							

TABLE IV-9

STATISTICAL SUMMARY OF EDMONTON GEOGRAPHIC ORIGINS OF THE U OF A STUDENT AND STAFF TRAVEL MODES AUTOMOBILE DRIVER, CAR POOL, AND DROP-OFF 1970/1971

TRAVEL MODE	CITY SIDE	CITY SIDE DISTRIBUTION 1970/1971				NUMBER OF PEOPLE IN EFFECTIVENESS ZONES 1970/1971			
		STUDENTS		STAFF		STUDENTS		STAFF	
		NO.	%	NO.	%	NO.	%	NO.	%
AUTO DRIVER	Northside	2571	53.1	678	38.3	872	33.9	210	29.2
	Southside	2272	46.9	1091	61.7	840	37.0	508	43.8
			100		100				
CAR POOL	Northside	593	55.6	98	38.0	133	22.4	29	29.6
	Southside	474	44.4	160	62.0	166	35.0	64	40.0
			100		100				
DROP-OFF	Northside	416	51.8	60	31.4	118	28.4	17	28.4
	Southside	387	48.2	131	68.6	134	34.6	51	39.0
			100						

TABLE IV-10

STATISTICAL SUMMARY OF ESTIMATED U OF A STUDENT AND STAFF EDMONTON RESIDENTIAL PATTERNS TO 1981/1982

YEAR	NORTHSIDE		SOUTHSIDE		TOTAL
STAFF	NO.	PERCENT	NO.	PERCENT	
1970/71	1129	32.8%	2311	67.2%	3,440
1981/82	3100	37.9%	5079	62.1%	8,179
	CHANGE	+5.1%		-5.1%	
STUDENTS					
1970/71	6574	36.2%	11598	63.8%	18,172
1981/82	11658	44.5%	14542	55.5%	26,200
	CHANGE	+8.3%		-8.3%	

BALANCE WITHIN CAR-RAPID TRANSIT EFFECTIVENESS ZONE
WITH RESPECT TO APPROPRIATE CITY SIDE

STUDENTS

YEAR	1970/1971	1981/1982	DIFFERENCE
NORTHSIDE	33.5%	33.5%	0.0%
SOUTHSIDE	17.9%	24.6%	+6.7%
STAFF			
NORTHSIDE	29.8%	32.3%	+2.5%
SOUTHSIDE	31.3%	46.2%	+14.9%

recognizing estimated 1981/1982 city wide university population shifts in relation to the base year of these calculations being (1970/1971). A sample automobile-oriented mode split will now be estimated to demonstrate the method used in arriving at the mode splits.

Sample calculation of estimated diversion of 1981/1982 staff automobile drivers of TABLE IV-5, over to rapid transit

North Side Edmonton

TABLE IV-5 Staff x TABLE IV-9 N. Side %

4135 x 38.3% = 1583

+ TABLE IV-10 Staff Shift x % effective + TABLE IV-9, increased staff to
1981/1982 in effectiveness
zone x assumed Diversion

[1583 + (5.1 x 1583)] x 29.2% = [487 + (2.5% x 487)] x 0.8

= 400 Auto Drivers

South Side Edmonton

4135 x 61.7% = 2555

[2555 - 5.1 (2555)] x 43.8% = [1063 + (14.9 x 1063)] x 0.8

= 977 Auto Drivers

Total 1981/1982 staff automobile driver diversion
to rapid transit = 1377 Auto Drivers

Continued 1981/1982 staff automobile drivers
= 4135 - 1377 = 2758 Auto Drivers

The last step in the mode split estimations was to perform all such automobile oriented student and staff mode diversion calculations, similar to the above example, followed by summarizing the overall mode

split (Ref. TABLE IV-11). Note that the assumed diversion of 80% of the automobile oriented campus bound trips to rapid transit use recognizes that there always will be a significant percentage of people, living inside of the car to rapid transit effectiveness zones, who will use automobiles exclusively. Also note the mode other was left untouched from the predicted mode split without rapid transit to the prediction with rapid transit, there being no reason to change it.

This concludes the university mode split estimations to 1981/1982, which will become an input to the transportation planning discussions that follow.

TABLE IV-11

THE UNIVERSITY OF ALBERTA

ESTIMATED 1981/1982 TRANSPORTATION MODE SPLIT

ASSUMING RAPID TRANSIT AVAILABLE

MODE	STUDENTS	STAFF	TOTAL USERS
AUTO DRIVER	3771	2758	6529
CAR POOL	1211	675	1886
DROP-OFF	777	272	1049
BUS	7287	1065	8352
RAPID TRANSIT			
FROM BUS	4218	664	
FROM CAR	2186	1821	
FROM WALK	659	87	
TOTAL	7063	2572	9635
WALK	5567	673	6240
OTHER	524	164	688
TOTAL PEOPLE	26,200	8,179	34,379

CHAPTER V

DISCUSSION OF MODE SPLIT ESTIMATIONS

5.1. General

This chapter of the study deals with a discussion of the future mode split estimation results and the salient features of the method by which they were obtained. As such, the major elements of The University Transportation Prediction Model are reviewed as is the method in which the model was used. The discussion will be completed upon an evaluation of the possible meaning of the mode split estimations for university transportation planning purposes.

5.2. Transportation Mode Split Method

The development of The University Transportation Prediction Model of this study was made feasible because of the inseparable nature of people and their transportation needs, as clearly identified in past campus transportation studies (1, 2, 34).

The development of the prediction model was possible because past transportation studies yielded knowledge on neighbourhood student generations and staff origins, in addition to the study of analytical transportation elements. This knowledge plus the information on existing and probable city growth provides the basis to model growth in university populations with additional and evolving transportation needs. The involvement and interrelationships of the City of Edmonton's

growth, university students, and U of A campus transportation is identified and utilized in the model. The model is thus an estimation or prediction tool in that as the inputs of people and residential land use and city travel opportunities and characteristics change, the outputs, or city and university transportation requirements change. The use of the prediction model in estimation, based on the best possible data available to the researcher at this time, has been demonstrated once in this study. Obviously, if and when better input data are available in the future, the results could be re-estimated for more accurate predictions. This study identifies areas such as trip diversion to public transit where better data are needed.

Taken in its broadest context the prediction model consists of the following elements:

1. the travel time difference mode use curves for bus and walk campus transportation (Ref. FIGURES 3.7 to 3.11),
2. the city and university travel modes and travel times, present and estimated future (Ref. TABLES III-2, III-3, and IV-1, and IV-2),
3. the detailed city-wide record of university travel mode use (Ref. CHAPTER III), and
4. the City of Edmonton present and likely future population by neighbourhoods complete with anticipated student generations and staff origins (Ref. TABLE II-26).

The following brief review will now highlight the methodology of use of the above model elements.

With respect to the development of a reliable analytical tool to explain and measure recent university student and staff mode splits, the travel time difference method was quite superior to the travel time ratio method which did not explain staff mode split (Ref. FIGURE 3.4). The third degree polynomial family of curves was found to be the most accurate graphical presentation of recent mode splits consistently having the least sum of square errors (Ref. APPENDIX II). Three major modes (bus, car and walk) had to be fully analyzed to obtain the travel time difference curves (Ref. FIGURES 3.7 to 3.11), and special care had to be taken in curve development for city areas of small travel time differences where walk takes precedence over bus. Positive curve progression, which was identified between study years, could only be partly explained on the basis of gradually lengthening city travel times.

Portal to portal travel times as given by over 20,000 university students and staff in the 1970/1971 campus origin-destination survey (Ref. APPENDIX II) form the basis of the travel time difference method. This data was found to be of high quality and with excellent Metropolitan Edmonton coverage (Ref. sections 3.6 and 4.2). Portal to portal travel times were found to be of high value to analytical mode split determinations as they covered the overall trip via the various travel modes that campus bound travellers must make. The best bus service imaginable, for example, would measure up poorly on a portal to portal basis if a twelve block walk to the bus stop were involved. The portal to portal travel times of this study therefore, fit perfectly with Hill and Von Cube's (30) five basic determinants governing the basis of travellers' choice in available travel modes. The public seems to be aware of the portal to portal travel time outlays necessary to utilize the various

travel modes, but probably does not concern itself as much with the travel time requirements of the trip segments, such as a link time. Portal to portal or marketplace travel times are not constant as proven in this study (Ref. section 3.2).

Regarding the sensitivities of travel times in the method of this study, the large number of METS zones and people in a given travel time difference category, and the large time intervals used (five minutes), make for relatively stable results. If the future travel time out of a given METS zone changes by one minute or so it may still fall in the same broad five minute travel time difference category, if it does change category, it may be offset by another METS zone changing oppositely. The travel time difference method itself has built-in stability in the sense that if travel time turns out differently than anticipated it is quite probable that car and bus travel times would change together, thus maintaining comparable differences. Walking time on the other hand will remain relatively constant. Growth in use of this mode will depend upon lengthening portal to portal car and bus travel time.

The University of Alberta transportation studies since 1965/1966 (1, 2, 34) have provided a uniform, reliable, and detailed account of the evolution of campus mode splits (Ref. TABLES III-2 and III-3). This information was essential to the method of the prediction model, providing knowledge and confidence in estimating further mode use changes. In this regard the exact details of past student and staff travel patterns can be accommodated in the prediction model to account for differentiated use of the various travel modes across the City of Edmonton. The detailed record of university parking supply and demand

supports the overall method of the study as a determinant to travel mode choice. Campus parking supply was shown (Ref. section 3.8) to have exhibited little constraint on campus mode splits to 1970/1971. The one major weakness of the use of the prediction model is the lack of detailed travel mode use data covering trip diversion to superior forms of public transit. This fact is recognized in the thesis (Ref. section 4.4.2) and corrective studies suggested.

Regarding the use of the residential land use configurations of the City of Edmonton (57) in the prediction model, the following points on methodology are worthy of note.

1. The City of Edmonton growth is monitored and planned very carefully (57, 59, 60) yielding good quality data for this study. Four of the six new outline plan areas of proposed city growth are under development (7, 8, 9, 39, 43, 66).
2. The age of subdivision research (Ref. section 2.2.2(c)) provided the basis whereby 41,300 members of the projected 1981/1982 city population were not considered for major university student generations (Ref. TABLE II-22). This may also be viewed as a conservative measure to account for some degree of flexibility in city growth.
3. Any unforeseen long run change in city growth plans or major departure from the General Plan (57), would necessitate re-estimation of The University Transportation Prediction Model.

5.3. Discussion of Mode Split Estimation Results

At the outset of this discussion it may be wise to briefly review what the estimations of this study pertain to. In summary, the mode split estimations have been performed on The University of Alberta at a population of approximately 8,000 staff, 25,000 full-time, and 1,200 part-time day, winter session students (Ref. TABLE II-26). This study has demonstrated that this general magnitude of related demand upon the U of A is feasible by 1981/1982, provided that the economy of Alberta is strong and not beset by a recession as in 1970/1971 (Ref. section 2.2.1(c)). If there were economic troubles this size of demand could occur at a later date. In this study a possible 2% to 4% overestimate on staff and part-time day, winter session students was justified as the contribution of campus peak hour visitors to the campus transportation problem. The study has therefore not accounted for University Extension (50), late afternoon and evening credit, casual bookings, or community use of university facilities. Of even greater significance, the study does not deal with the large University of Alberta Hospital, the Aberhart Memorial Hospital, the Research Council of Alberta, the W. W. Cross Cancer Institute, the Jubilee Auditorium, or the increasingly dense south Garneau high-rise apartment and commercial area. These facilities are located on or adjacent to the campus. Although these traffic generators are not part of this study, their growth implications should obviously be of some real concern to The University of Alberta and the City of Edmonton.

To proceed with the discussion of the mode split estimation results it is necessary to restate the major technical assumptions of the study as follows:

1. The extent of the diversion of trips to the proposed Edmonton Rapid Transit System (13) could not be measured and was therefore assumed with a reasonable degree of insight into the problem. The study proposes a public transit diversion study (Ref. section 4.4.2) to correct the need to measure city transit diversions.
2. Future city travel times for car and bus were not measured but rather estimated on the basis of reliable data.
3. The future size of the city was assumed from the City of Edmonton General Plan (57) (Ref. FIGURE 2.12).
4. Several broad city residential distributions of university people were assumed to be generally similar in 1981/1982 to 1970/1971. The origins of the mode other, for example, were assumed to remain close to campus on Edmonton's south side. Also, university staff will likely continue to have substantial residential concentrations in south and west Edmonton.

In keeping with the technical assumptions, the mode split results and discussions that follow must be viewed as being based on possible estimations only, to be weighed or evaluated accordingly.

The estimated mode splits with and without the use of rapid transit, as summarized on TABLE V-1, raise some very interesting and challenging questions in the future development of The University of Alberta. In overview, the mode split figures are eluding to a major problem in the phasing of transportation facilities development to ensure a smooth transition to the assumed start of rapid transit. The problem is one of satisfying the interim essential transportation

TABLE V-1

THE UNIVERSITY OF ALBERTA

SUMMARY OF COMBINED STUDENT AND STAFF

ACTUAL AND ESTIMATED TRANSPORTATION MODE SPLITS

TRANSPORT MODE		1970/1971 ACTUAL	1981/1982 WITH NO RAPID TRANSIT	1981/1982 WITH RAPID TRANSIT	1981/1982 DIFFERENCE IN MODE SPLITS
Auto	No.	8087	9460	6529	-2931
Driver	%	32.8	27.5	19.0	
Car	No.	1587	2554	1886	-668
Pool	%	6.4	7.4	5.5	
Passenger	No.	1219	1457	1049	-408
Drop-Off	%	5.0	4.3	3.0	
Bus	No.	6810	13,234	8352	-4882
	%	27.6	38.5	24.3	
Rapid	No.	-	-	9635	+9635
Transit	%	-	-	28.0	
Walk	No.	6525	6986	6240	-746
	%	26.5	20.3	18.2	
Other	No.	422	688	688	0
	%	1.7	2.0	2.0	
Total	No.	24,650	34,379	34,379	0
People	%	100	100	100	-

needs of the university's students and staff, notwithstanding, maintaining a good campus educational environment and extracting prudent long range educational use from a scarce campus resource: land (Ref. APPENDIX III, environment). In short, the difference on parking demand between the two predictions may not be needed for all time. The key idea to imagine here, is how and where is this parking to be provided if existing public transit is unable to win over university people who might otherwise be campus parkers?

Turning to the estimated mode splits (Ref. TABLE V-1), the following observations are in order: The long standing campus transportation trend (Ref. TABLE III-2 and III-3) towards more use of public transit will continue with or without receipt of rapid transit. Without rapid transit the Edmonton Transit System could be required to carry, for The University of Alberta, about 13,000 home to work trips per day, or roughly 26,000 total trips. To set this in perspective, this is double the number of trips carried in 1970/1971 (10), implying up to twice the number of buses if crush loading is to be averted. When this magnitude of bus transit loading is viewed in relation to an additional 1,500 campus cars merged with other traffic generations in the area, it appears the possible future transportation situation cannot be handled without some adverse affect on the campus educational environment (Ref. APPENDIX III). More space demands for transportation facilities, noises, exhausts, visual pollution, congestion, and stress and strain, may be possible problems. This is an educated viewpoint which should be validated with further research. Note that the use of cars instead of bus transit would only tend to worsen the future possible transportation and campus environmental situation, as many more cars carrying

an average of 1.30 or more passengers per car, would be required to do the job of 40 to 60 passenger buses.

There are two striking aspects to the public transit situation alluded to in the estimations of this study. First, if conventional bus transit is going to do the job expected of it, it must actively compete with the comfort and conveniences of the automobile, to reduce the "quality gap" identified in 1970/1971 (10). As this study shows, weekly outlays of portal to portal, or marketplace, transit travel times of 1970/1971 were often excessive in relation to more productive use of time. Looking to the future, with anticipated city growth (57), more and longer commuting to U of A is inevitable. The future success in bus transit lies in steadily improving reliability of service, directness of routing, etc., and essential user conveniences such as bus shelters at key points throughout the city. The new start on changes and improvements in public transit (10, 11) should continue, as indeed public transit improvements are exactly what the majority of the City of Edmonton citizens recently expressed that they want (54, 55). Fortunately, The University of Alberta is positively sensitive to improvements in public transit.

The second aspect, however, recognizes that there likely is a limit to the improvements to bus transit that can be made. At some stage of city growth and bus transit development it probably will become too expensive to reduce the "quality gap" (10) any further. The possible problem is that the campus educational environment could suffer from general university area traffic even before the above stage is reached. The feasibility of handling the transportation load estimations of this study requires additional consideration.

In reviewing the estimated mode splits (Ref. TABLE V-1), the transportation situation, assuming the use of rapid transit (13), can be handled with greater ease as no campus load, other than rapid transit itself, is substantially in excess of experience to date. In fact, the most illuminating comment that could be made here is that the estimated mode split, assuming the use of rapid transit, can be envisaged as a transportation situation similar to 1970/1971, with improved potential environmental factors such as; fewer automobiles and commensurate space demands. Greater campus densities with rapid transit appear to be feasible with less demands on parking and roadway space. Rapid transit would save substantial amounts of weekly travel time for those using it (4, 13), also providing for potentially greater campus arrival and departure travel efficiencies.

Assuming the receipt and use of rapid transit (13), there would be roughly 9,600 more campus walkers (Ref. TABLE V-1) diverging from two specific stations (13). If these walkers were merged with the estimated walk and bus mode people it could have serious impact upon the desired environmental quality of related campus academic space. The estimated combined campus walking loads thus deserve careful space planning attention.

A major technical assumption on transit trip diversions was made in the study regarding rapid transit. The lack of diversion data should be corrected as soon as possible (Ref. section 4.4.2), and The University Transportation Prediction Model re-estimated on the basis of better data. The study utilized a theoretical, yet sound, method (Ref. section 4.4.2) to obtain the zones of rapid transit effectiveness (Ref. FIGURE 4.2). Nevertheless, the fact remains that the zones may not be as definite as

shown, dependent upon ultimate bus routing to rapid transit, etc. A noticeable example would be that Highway 16 East may extend the north side Edmonton zone of rapid transit effectiveness to the south side at 118 Avenue. In this regard the transportation planning implications are such that, if the effectiveness zones increase in size, the rapid transit estimations will also increase, other things remaining equal. With respect to the assumed 80% bus and car, and 70% walk, to rapid transit diversions, the implications of a high diversion estimate are that U of A would necessarily have to accommodate more bus, car, and walk people, in proportion to any reduction in the diversion estimates. The walking mode is least sensitive to any diversion reduction by way of the 70% (vs. 80%) diversion estimate. In addition the rapid transit alignment and stations (13) would be irrelevant to the greatest densities of campus bound walkers (e.g. south Garneau). Thus, walking will continue to be an important campus mode deserving of careful service and planning attention.

The study has referred to the initial Edmonton Rapid Transit System (13) and tends to assume that it will not be more than a year or two old in 1981/1982. This point deserves clarification. In essence, this study deals only with the first several lines of the proposed overall rapid transit system (4, 13), assuming that by 1981/1982 it will not have had sufficient time to impart any realignment, or changing patterns, in city residential land use. Such changes will inevitably occur, assuming rapid transit is developed, as has been the case in other cities (65). This study recognizes this factor, and suggests that any such changes go against a technical assumption of the study indicating remodelling the prediction model on newer data.

Continuing with mode split estimation results (Ref. TABLE V-1), and assuming U of A and other institutions on campus will get larger, the probable density of campus area transportation needs is such that it will be imperative that transportation conflicts be identified and planned for, otherwise capacity will fall and congestion and chaos will result. Specifically; students and staff alighting from public transport should not block other public transport or cars. Bus transit headways will have to be scheduled tight and undue delays would be detrimental to the operation of the transit system. The mode passenger drop-off will continue to be important and critical to the extent that it should be closely regulated, and performed, in specific passenger drop-off bays removed from moving lanes of traffic. Untimely and illegal passenger drop-off occurrences in moving traffic lanes will be very detrimental to the transportation system at high density. The provision, and upkeep by season, of adequate pedestrian ways should not conflict with vehicles. Continued good use of traffic lights and/or pedestrian grade separations will be required. The mode other is predicted to continue at a significant level and provision for bicycles out of the way of vehicles in the whole university area would be very wise. And lastly, the provision of proper vehicular turn-offs from major arterial roadways should be done efficiently, with proper turning radii and other geometrics, quite unlike current inadequate turn-offs (e.g. 114 Street South).

To sum up the possible meaning of the mode split estimation results; a lower university enrolment than demonstrated as possible in this study does not necessarily, of itself, resolve the possible future university area transportation problem. From a transportation engineering point of view the students used in this study may be viewed, in

part, as a quantifiable load representative of other unquantified groups, such as Extension (64) (Ref. APPENDIX III). The introductory remarks of this discussion allude to the possibility that groups other than the university, singly or together, could precipitate transportation demands injurious to the campus educational environment. This matter is open to study. The mode split estimations of this study (Ref. TABLE V-1) indicate a possible buildup in university parking demand until the assumed receipt of the proposed Edmonton Rapid Transit System (13). This buildup will occur if the anticipated growth in conventional bus transit does not meet the related transportation needs. Additional campus parking for university people could be essential for a time and then not needed upon receipt of rapid transit. What the interim transportation and the campus educationally oriented land use values situation is calling for, is satellite parking, as and when required. Campus landscaping, etc., need not be delayed five years or more pending rapid transit. In essence, a system of park and bus ride, in preparation for the days of park and rapid transit ride, may be the answer. The transit diversion study suggestion of this study is such a system (Ref. 4.4.2).

The provision of surface transportation capacity is often such that the influence of other university area traffic generators, plus additional interim or lasting university parking, could inadvertently set in motion development injurious to the campus environment. The simple removal of a boulevard of beautiful mature trees, for example, may be as harmful to a campus environment as developing a freeway through a quiet residential district (54, 55). The philosophy of removing any excess in parking when rapid transit arrives appears to be unwise. Moreover, the untimely arrival at the surface transportation capacity in the

campus area, caused by density of vehicles, could prematurely discount the full utility of campus educational facilities. Because of these possibilities a long range view to sound campus transportation provision and planning is important; tomorrow's imperatives today.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this research project was to establish the transportation determinants necessary to develop a campus transportation prediction model. This project used the model to estimate and assess the possible university mode splits in one decade. In doing this research, many factors and transportation determinants to travel mode choice were analyzed, including possible city and university size. The initial impact of the proposed Edmonton Rapid Transit System (13) on The University of Alberta was viewed as an assist to long range campus transportation planning. Because rapid transit trip diversion could not be measured, this work represents possible estimations only. The main source of data was university origin-destination studies conducted between the 1965/1966 and 1970/1971 campus academic years, and the major conclusions of the investigation are as follows:

1. The university transportation pattern is such that three (automobile, bus, walk) and not just two (automobile and bus) transportation modes must be developed by analytical means to predict mode splits.

2. The travel time difference measure of relative travel time to The University of Alberta is a relevant reliable measure and the travel time ratio measure is not.

3. Portal to portal travel time is the best travel time measure for analytical mode split determinations as it covers all segments of the trip that campus bound people must make. Portal to portal, or marketplace, travel time by bus and car has deteriorated in Edmonton from 1965/1966 to 1970/1971, as evidenced in this research. This being the case individual link travel time deterioration for the home to work trip is a distinct possibility.

4. The University of Alberta is positively sensitive to improvements in public transit service. Public transit will play a role of increasing importance in servicing The University of Alberta.

5. It is probable that The University of Alberta could experience an equivalent student population of 25,000 full-time day, winter sessions students by 1981/1982. This assumes a strong Alberta economy until then. In view of the intended residential land use shape of the city (57), more commuting will be required by many students and staff, and weekly travel time outlays will continue to be substantial with present means of transportation.

6. With no rapid transit in service by 1981/1982 (13), The University of Alberta will probably require 1,500 additional car parking spaces and will need up to double the number of buses of 1970/1971 (10). This magnitude of possible additional transportation facilities space demands appears to be potentially harmful from the point of view of the desired educational environment (Ref. APPENDIX III). Other major university area traffic generators complicate the situation such that lower enrolment does not, in itself, necessarily solve the probable transportation problem.

7. Assuming the initial possible university use of the proposed Edmonton Rapid Transit System (13), over 9,000 students and staff will use it. This would allow a reduction of 1,500 stalls to current (1970/1971) campus parking stock. Such a reduction to campus space demands would allow for greater campus densities and a potentially better campus environment. From the university's point of view, the proposed northwest branch of rapid transit (13) has limited utility in its present proposed form.

In addition to the major conclusions above, the following important minor conclusions are presented from this research investigation:

1. The desirability of the use of public transit (bus) by students and faculty and staff diminishes rapidly for home to work portal to portal transit travel times exceeding sixty minutes. At this upper transit travel time boundary, weekly travel time outlays are excessive in relation to more productive use of time.

2. Through good planning and management, and changed use of campus bound automobiles, there has been no significant parking constraint by 1970/1971 at The University of Alberta. The changed use in student and staff parking needs manifests itself in greater parking turnovers and increased group riding or car pooling.

3. Assuming rapid transit will be developed, a campus transportation policy needs adoption to match parking provision to long range needs. In essence, what may be required in the interim period is a system of park and bus ride, in preparation for the days of park and rapid transit ride. The philosophy of removing any excess in parking when rapid transit arrives, may be very unsound from the point of view of the campus environment.

4. Assuming the combined use of rapid transit, bus transit, and walking, the combined walking load at points of campus entry and beyond, may have very significant impact on the qualities of campus interior academic space. Walking will continue to be a very important campus travel mode and therefore deserves careful planning and operational (by seasons) attention.

5. With higher vehicular densities in the university area it will be imperative that surface, or roadway, transportation conflicts be minimized to maintain efficient traffic flow. In view of the great concern for the campus educational environment, bus routing, simple curb cuts, and strict stopping rules, are the kinds of things indicated and not major grade separated interchanges, or other excessive space consuming measures.

As a result of this research project the following points are offered as recommendations:

1. That a trip diversion to public transit study be undertaken at an early opportunity to measure trip diversions to superior forms of public transit. Such a study would be valuable in estimating, with greater confidence, the probable use of the proposed Edmonton Rapid Transit System (13).

2. That a campus origin-destination transportation study be undertaken in 1974/1975 for the purpose of re-estimating The University Transportation Prediction Model. Such a study would be designed to observe bus and car portal to portal travel time changes, mode use changes, and the city residential patterns of students and staff.

3. Additional research is required to identify the reason for positive curve progression between relevant years for the travel time difference mode split curves (Ref. FIGURES 3.7 to 3.11).

4. The annual week long joint City/University public transit cordon count study (10, 11) be continued to provide the basis for improvements in public transit to The University of Alberta.

5. That the City of Edmonton transportation planners continue to study and implement ways to reduce city wide portal to portal public transit travel times to U of A and area.

6. That the possibility of provision of direct bus service to U of A from St. Albert and Sherwood Park be explored in the near future. Such services should not exceed portal to portal travel times of sixty minutes and, desirably, should be faster.

7. That more transportation planning and operational attention be given to the travel modes walking and other (such as bicycle) throughout the university area. The mode walking should be recognized as a major campus travel mode.

8. As a result of the possible estimations of this study the following points should be given further study by The University of Alberta leading to the adoption of sound long range plans and policies.

(a) Consideration of the campus parking situation in view of the proposed Edmonton Rapid Transit System (13), but transit ridership increases to and from the campus, and the possibility of inadvertent damage to the desired campus educational environment.

(b) Consideration of an active policy with respect to the implications of university area developments (and plans) as they inevitably influence university area public facilities and spaces and the environment.

(c) The effects of the possible combined load of campus walkers from the bus, walking, and rapid transit modes on the desired educational qualities of campus academic space.

9. Sources of university area traffic generation other than The University of Alberta should be studied before city-wide transportation decisions are made respecting The University of Alberta area of the City of Edmonton.

10. The city and university cooperate in a program of the reduction of obvious and subtle transportation conflicts which will be very detrimental to efficient transportation with increasing campus densities. Such a program must recognize the transportation needs unique to the U of A such as very significant amounts of the passenger drop-off and the mode other. Change in transportation facilities should honor the desired campus educational environment.

11. That The University of Alberta continue to support the proposed Edmonton Rapid Transit System (13).

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APPENDIX I

DEMOGRAPHIC PLOTS AND POPULATION FORECAST INFORMATION

- Possible University Candidates
- Provincial Demographic Plots
- Canadian Per Capita Income
- Urban and Rural Economic Performance
- Edmonton Demographic Plots
- Student Lag Factors
- Canadian Economic Review
- Northern Alberta Economic Problems
- University Social Indices
- Alberta Colleges Enrolment
- University Future Staff-Transportation Planning Point of View

APPENDIX I

TABLE I-1A

OPERATIONAL RESEARCH POSSIBLE UNIVERSITY CANDIDATES***

Averages	50 - 54%			55 - 59%			Totals		
	1*	2**	Total	1*	2**	Total	1*	2**	Total
1969 POSSIBLE UNIVERSITY CANDIDATES									
Special Condition A	2	3	5	20	17	37	22	20	42
Special Condition B	43	27	70	419	337	756	462	364	826
Special Condition C	5	15	20	78	101	179	83	116	199
Non-Departmental Candidates	-	-	-	-	-	-	4	7	11
TOTAL	50	45	95	517	455	972	571	507	1,078
Averages less than 50%							1,309	694	2,003
1970 POSSIBLE UNIVERSITY CANDIDATES									
Special Condition A	-	-	-	8	7	15	8	7	15
Special Condition B	51	28	79	530	264	794	581	292	873
Special Condition C	7	9	16	82	112	194	89	121	210
TOTAL	58	37	95	620	383	1,003	678	420	1,098
Averages less than 50%							2,308	793	3,101
1971 POSSIBLE UNIVERSITY CANDIDATES									
Special Condition A	1	-	1	2	4	6	3	4	7
Special Condition B	59	19	78	436	212	648	495	231	726
Special Condition C	6	17	23	172	118	290	178	135	313
TOTAL	66	36	102	610	334	944	676	370	1,046
Averages less than 50%							3,144	1,100	4,244

NOTE: Special Conditions A, B, and C - Subject requirements were met. Averages less than 60%.

* Students completing grade 12 in one year.

** Students completing grade 12 in at least two years.

*** Source: Ref. 38.

APPENDIX I

TABLE I-1B

OPERATIONAL RESEARCH POSSIBLE UNIVERSITY CANDIDATES BY GEOGRAPHIC ZONE***

1971 POSSIBLE UNIVERSITY CANDIDATES

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Edmonton	Calgary	Others	Total
Condition A	70	206	147	200	142	224	621	539	34	2,183
Condition B	160	276	245	350	205	277	1,150	874	122	3,659
Condition C	36	94	73	83	47	91	419	308	71	1,222
Condition D	1	-	2	-	2	2	8	3	3	21
	267	576	467	633	396	594	2,198	1,724	230	7,085

1970 POSSIBLE UNIVERSITY CANDIDATES

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Edmonton	Calgary	Others	Total
Condition A	63	164	172	221	168	235	659	671	5	2,358
Condition B	143	309	279	370	209	294	1,053	824	29	3,510
Condition C	31	74	46	64	36	54	188	190	4	687
Condition D	-	1	3	-	-	-	5	4	-	13
	237	548	500	655	413	583	1,905	1,689	38	6,568

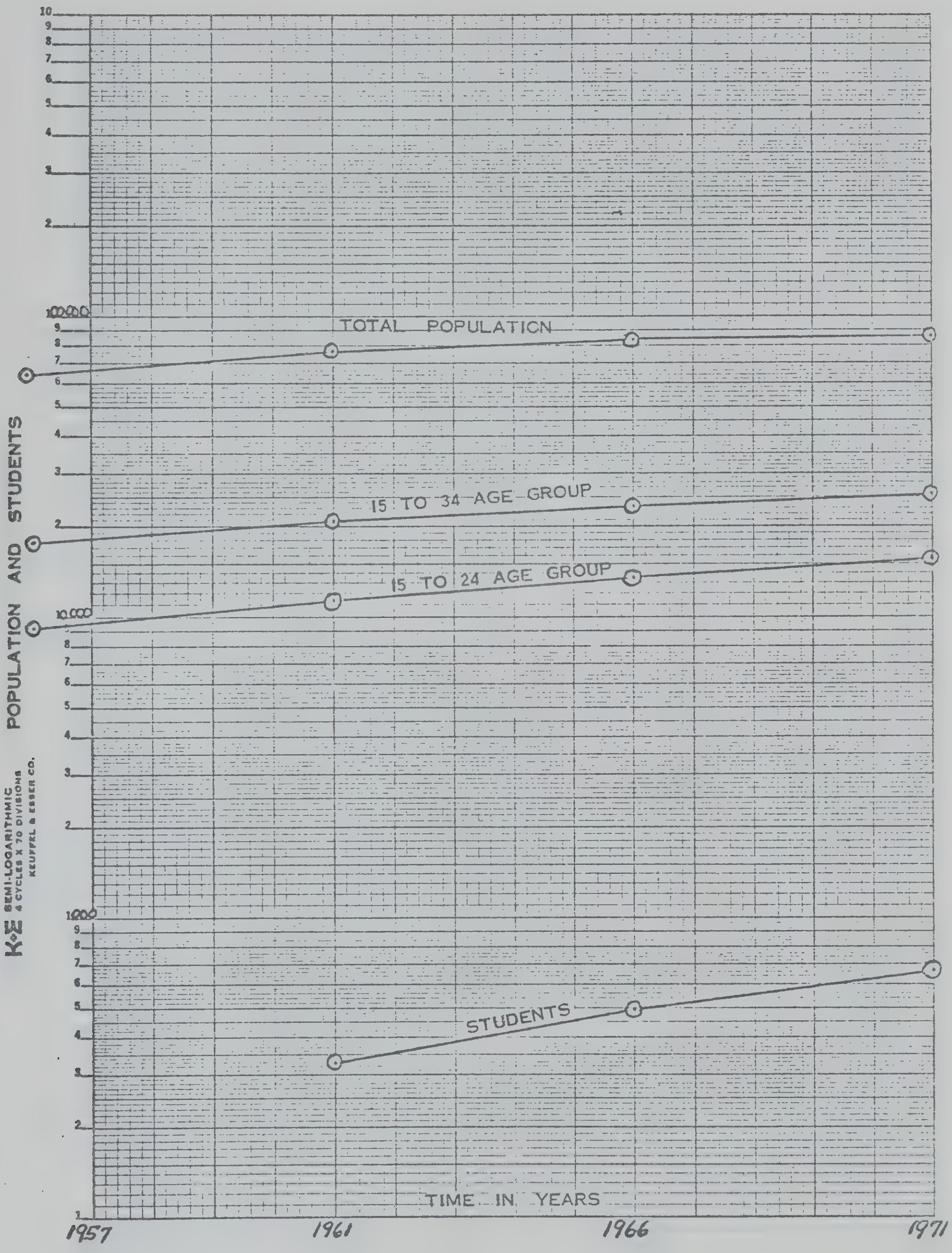
1969 POSSIBLE UNIVERSITY CANDIDATES

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Edmonton			Calgary	Others	Total
							1*	2**	Total			
Condition A	91	268	236	326	231	396	806	147	953	1,064	11	3,576
Condition B	120	279	251	299	160	318	854	75	929	597	18	2,971
Condition C	22	54	39	40	39	40	202	13	215	103	3	555
Condition D	1	-	1	-	1	2	6	14	20	4	1	30
	234	601	527	665	431	756	1,868	249	2,117	1,768	33	7,132

* Students who wrote Departmental examinations.

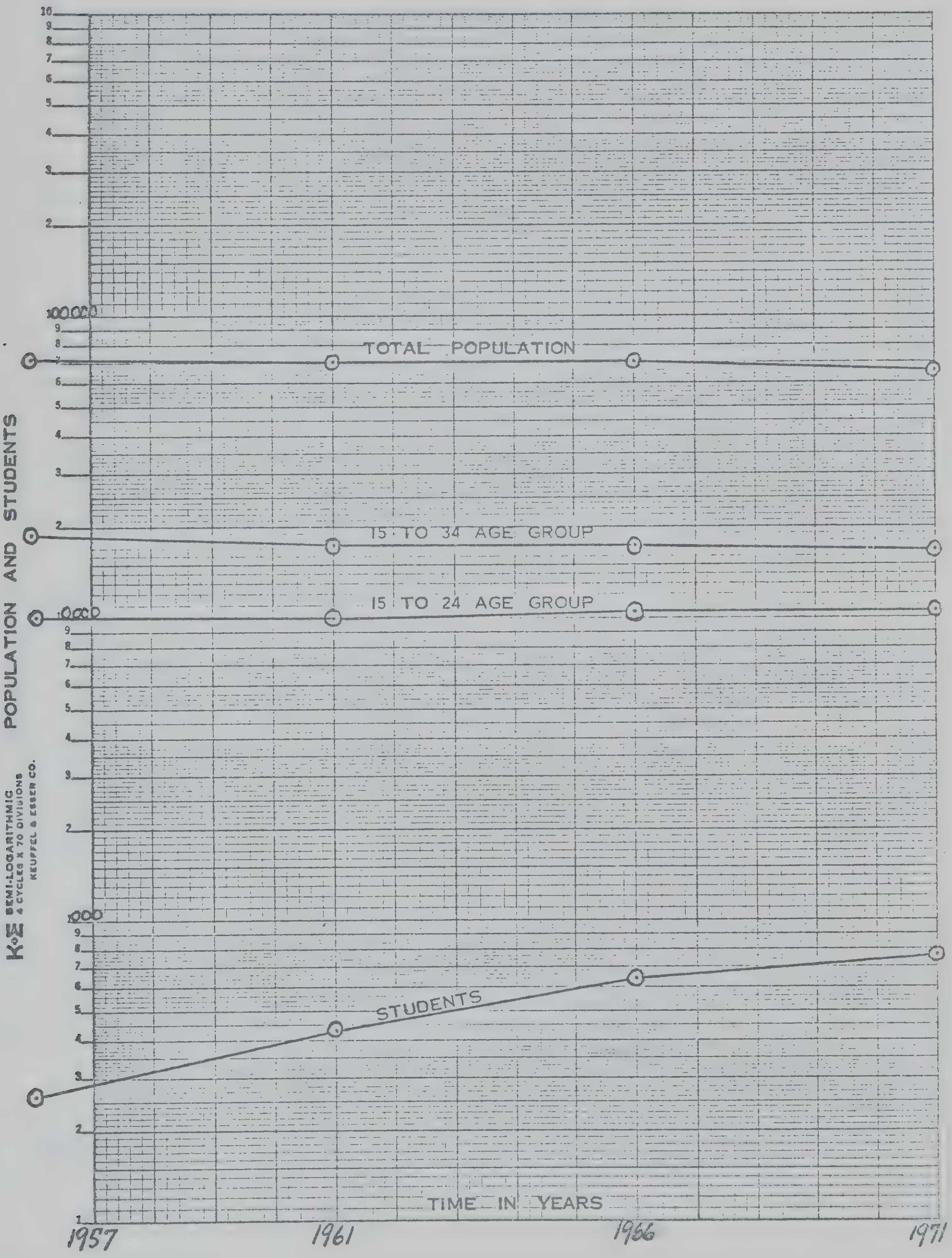
** Students who did not write Departmental examinations.

*** Source: Ref. 38.



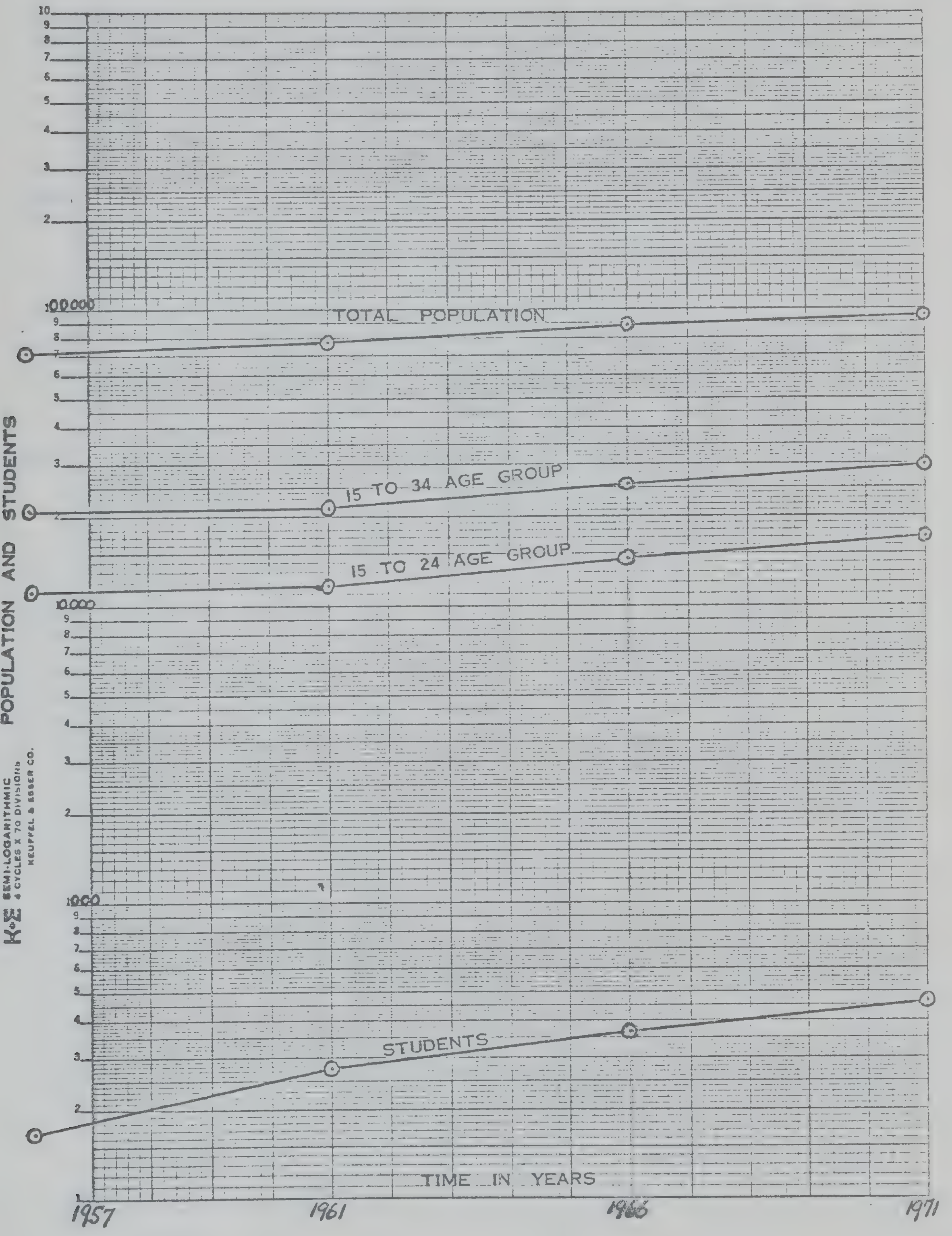
APPENDIX I

FIGURE 1.1. POPULATION AND TOTAL ALBERTAN UNIVERSITY ENROLMENT ALBERTA 1971 CENSUS DIVISION 8



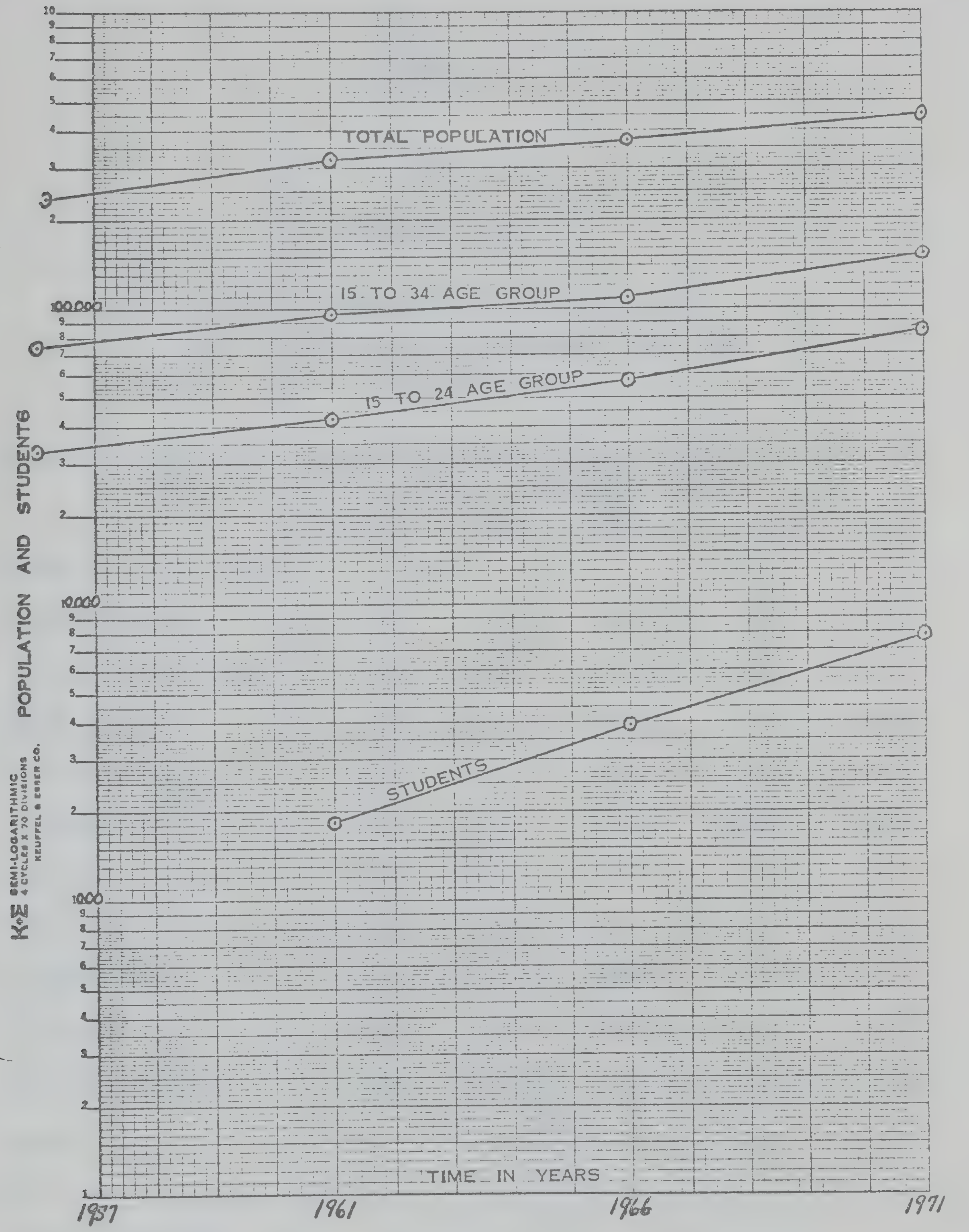
APPENDIX I

FIGURE 1.2. POPULATION AND TOTAL ALBERTAN UNIVERSITY ENROLMENT ALBERTA 1971 CENSUS DIVISION 10



APPENDIX I

FIGURE 1.3. POPULATION AND TOTAL ALBERTAN UNIVERSITY ENROLMENT ALBERTA 1971 CENSUS DIVISION 15



APPENDIX I

FIGURE 1.4. POPULATION AND TOTAL ALBERTAN UNIVERSITY ENROLMENT ALBERTA 1971 CENSUS DIVISION 6

APPENDIX I

TABLE I-2

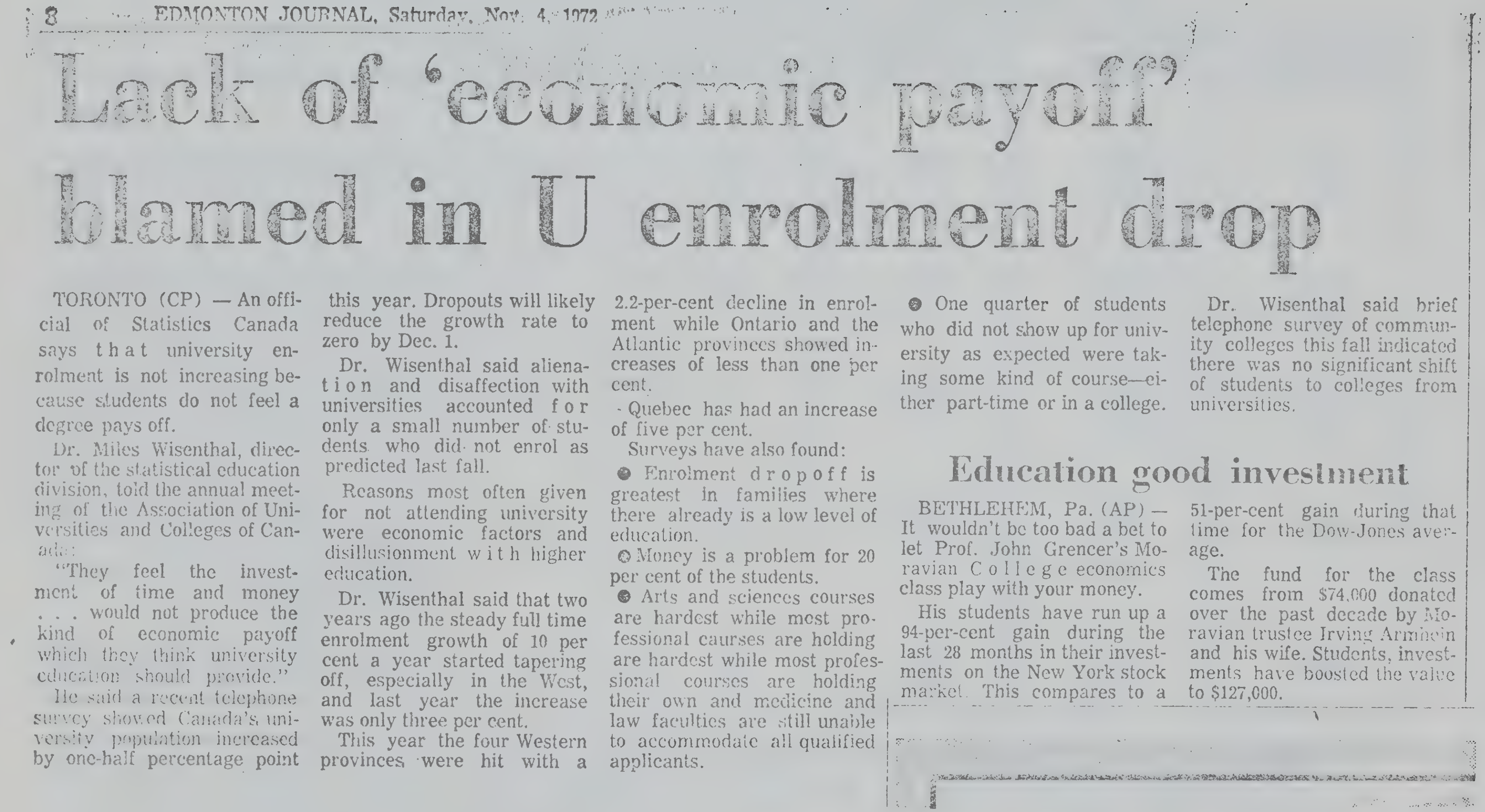
SERIES G: TABLE I

PERSONAL PER CAPITA INCOME CANADA AND THE PROVINCES, 1961, 1966, 1967, 1968, 1969*

(In Dollars)

	Per Capita Income				
	1961	1966	1967	1968	1969
Province:					
Newfoundland	932	1,274	1,398	1,489	1,617
Prince Edward Island	943	1,367	1,514	1,691	1,827
Nova Scotia	1,256	1,713	1,905	2,074	2,305
New Brunswick	1,099	1,571	1,739	1,910	2,088
Quebec	1,455	2,045	2,239	2,409	2,632
Ontario	1,908	2,648	2,842	3,064	3,371
Manitoba	1,546	2,153	2,407	2,658	2,843
Saskatchewan	1,146	2,154	2,089	2,396	2,517
Alberta	1,607	2,281	2,419	2,658	2,918
British Columbia	1,843	2,542	2,693	2,835	3,120
Canada	1,613	2,283	2,461	2,662	2,915

*Source: Ref. 48.



8 EDMONTON JOURNAL, Saturday, Nov. 4, 1972

Lack of 'economic payoff' blamed in U enrolment drop

TORONTO (CP) — An official of Statistics Canada says that university enrolment is not increasing because students do not feel a degree pays off.

Dr. Miles Wisenthal, director of the statistical education division, told the annual meeting of the Association of Universities and Colleges of Canada:

"They feel the investment of time and money . . . would not produce the kind of economic payoff which they think university education should provide."

He said a recent telephone survey showed Canada's university population increased by one-half percentage point this year. Dropouts will likely reduce the growth rate to zero by Dec. 1.

Dr. Wisenthal said alienation and disaffection with universities accounted for only a small number of students who did not enrol as predicted last fall.

Reasons most often given for not attending university were economic factors and disillusionment with higher education.

Dr. Wisenthal said that two years ago the steady full time enrolment growth of 10 per cent a year started tapering off, especially in the West, and last year the increase was only three per cent.

This year the four Western provinces were hit with a 2.2-per-cent decline in enrolment while Ontario and the Atlantic provinces showed increases of less than one per cent.

Quebec has had an increase of five per cent.

Surveys have also found:

- Enrolment dropoff is greatest in families where there already is a low level of education.
- Money is a problem for 20 per cent of the students.
- Arts and sciences courses are hardest while most professional caurses are holding are hardest while most professional courses are holding their own and medicine and law faculties are still unable to accommodate all qualified applicants.
- One quarter of students who did not show up for university as expected were taking some kind of course—either part-time or in a college.

Dr. Wisenthal said brief telephone survey of community colleges this fall indicated there was no significant shift of students to colleges from universities.

Education good investment

BETHLEHEM, Pa. (AP) — It wouldn't be too bad a bet to let Prof. John Grencer's Moravian College economics class play with your money.

His students have run up a 94-per-cent gain during the last 28 months in their investments on the New York stock market. This compares to a 51-per-cent gain during that time for the Dow-Jones average.

The fund for the class comes from $74,000 donated over the past decade by Moravian trustee Irving Armhein and his wife. Students, investments have boosted the value to $127,000.

APPENDIX I

TABLE I-3

SUB-PROVINCIAL LABOUR FORCE PARTICIPATION AND UNEMPLOYMENT RATES*

	JUNE 1970	JUNE 1971	AVERAGE 1971	MAY 1972	JUNE 1972+
CALGARY					
Labour Force Participation Rate %	N/A	61.3	60.5	63.7	65.0C
Labour Force Unemployment Rate %	N/A	2.9	5.5	4.8	3.9F
EDMONTON					
Labour Force Participation Rate %	N/A	63.4	62.2	62.9	63.9C
Labour Force Unemployment Rate %	N/A	4.0	5.2	5.4	5.6F
CENSUS DIVISIONS 5, 6, & 9					
Labour Force Participation Rate %	N/A	60.9	59.9	61.8	63.7C
Labour Force Unemployment Rate %	N/A	2.7	5.0	4.5	3.6F
CENSUS DIVISION 8 & 11					
Labour Force Participation Rate %	N/A	62.4	61.2	62.0	62.7C
Labour Force Unemployment Rate %	N/A	3.8	4.9	4.7	5.0F
CENSUS DIVISIONS 1,2,3,4,7,10,12, 13,14, & 15					
Labour Force Participation Rate %	N/A	58.4	56.5	58.7	59.3C
Labour Force Unemployment Rate %	N/A	4.5	3.8	3.4	3.2F

+The alphabetic symbol following each figures represents an estimate as to the accuracy of the current survey figure. If this figure is expressed with an "A", the chances are 68 out of 100 that the corresponding census figures would have fallen to within ± 0.5% of the figures shown; "B", within ± 1.0%; "C", within ± 2.5%; "D", within ± 5.0%; "E", within ± 10.0%; and "F", within ± 16.5%. Alphabetic symbols are also used in the table titled, "Sub-Provincial Labour Force Participation and Unemployment Rates."

* Source: Ref. 14.

APPENDIX I

TELEPHONE 429-5846

UNIFARM

AN ORGANIZATION OF ALBERTA FARMERS AND THEIR ASSOCIATIONS

9934 - 106 STREET
EDMONTON 14, ALBERTA
CANADA

July 6th, 1972.

Mr. W. J. Williamson,
Institutional Research and Planning,
University Hall,
University of Alberta
Edmonton, Alberta.

Dear Mr. Williamson:

As requested by telephone here is some background information on farm income in Alberta.

The only source of farm income by region in Alberta for a 12 month period in 1970-71 will be available from Statistics Canada early in 1973 from the June 1971 census.

Grain prices except for rapeseed, were down in 1970 and so were grain sales because of quota restrictions.

Livestock sales were strong and helped keep farm income up in 1970. Beef prices at $28.90 per cwt, were very good. However, Census Divisions 12, 13, 14 and 15 had only 10% of the sales. Hog prices were average at $28.40 and 25% were sold in the same regions as above.

The same region produced 16.5% of the field crops in 1970 and prices were down from previous years. About 30% of the cash advances would be for Alberta.

Yours truly,
Elmer Allen
Elmer Allen, P. Ag.
Research Economist.

EA/ww

Encl.

APPENDIX I

TABLE I-4

THE CANADIAN WHEAT BOARD ANNUAL REPORT 1970

EXHIBIT VI

EXHIBIT VI
STATEMENT OF ADVANCE PAYMENTS TO PRODUCERS UNDER THE PRAIRIE GRAIN ADVANCE PAYMENTS ACT As at July 31, 1970

	Cash Advances	Advances repaid	Balance to be refunded
1957-58 Crop Year	$ 35,203,467	$ 35,200,780	$ 2,687
1958-59 Crop Year	34,369,653	34,365,596	4,057
1959-60 Crop Year	38,492,505	38,488,393	4,112
1960-61 Crop Year	63,912,550	63,902,669	9,881
1961-62 Crop Year	16,656,713	16,649,316	7,397
1962-63 Crop Year	29,251,526	29,243,846	7,680
1963-64 Crop Year	62,136,418	62,120,728	15,690
1964-65 Crop Year	32,961,844	32,949,405	12,439
1965-66 Crop Year	40,600,386	40,583,478	16,908
1966-67 Crop Year	36,668,270	36,647,610	20,660
1967-68 Crop Year	47,280,533	47,236,917	43,616
1968-69 Crop Year	151,852,319	147,364,097	4,488,222
1969-70 Crop Year	272,777,141	135,472,573	137,304,568
	$862,163,325	$720,225,408	
Balance to be refunded by Producers as at July 31, 1970			141,937,917
Add:			
Bank interest to July 31, 1970 payable by the Government of Canada		28,484,602	
Less: Amount paid to July 31, 1970		27,411,512	1,073,090
			143,011,007
Deduct:			
Balance of funds received to cover advance payments in default:			
Government of Canada		65,277	
Line Elevator Companies		7,254	
Interest received on default payments		380,755	453,286
Owing to The Canadian Wheat Board as at July 31, 1970			$142,557,721

EXHIBIT VII
STATEMENT OF PROVISIONAL PAYMENTS TO PRODUCERS ON UNTHRESHED GRAIN UNDER THE PRAIRIE GRAIN PROVISIONAL PAYMENTS ACT, 1969-70 As at July 31, 1970

Cash advances to Producers	$1,204,852	
Less: Advances repaid by Producers	393,088	
Balance to be refunded by Producers as at July 31, 1970		$811,764
Bank interest to July 31, 1970 payable by the Government of Canada	41,600	
Less: Amount paid to July 31, 1970	35,059	6,541
Owing to The Canadian Wheat Board as at July 31, 1970		$813,305

APPENDIX I

TABLE I-5

THE CANADIAN WHEAT BOARD ANNUAL REPORT 1971

EXHIBIT VI

EXHIBIT VI
STATEMENT OF ADVANCE PAYMENTS TO PRODUCERS
UNDER THE PRAIRIE GRAIN ADVANCE PAYMENTS ACT
As at July 31, 1971

	Cash Advances to Producers	Advances Repaid by Producers	Balance to Be Refunded By Producers
1957-58 Crop Year	$ 35,203,467	$ 35,200,780	$ 2,687
1958-59 Crop Year	34,369,653	34,365,874	3,779
1959-60 Crop Year	38,492,505	38,489,505	3,000
1960-61 Crop Year	63,912,550	63,902,852	9,698
1961-62 Crop Year	16,656,713	16,650,027	6,686
1962-63 Crop Year	29,251,526	29,245,423	6,103
1963-64 Crop Year	62,136,418	62,121,968	14,450
1964-65 Crop Year	32,961,844	32,951,439	10,405
1965-66 Crop Year	40,600,386	40,586,647	13,739
1966-67 Crop Year	36,668,270	36,651,588	16,682
1967-68 Crop Year	47,280,533	47,254,325	26,208
1968-69 Crop Year	151,852,319	150,196,074	1,656,245
1969-70 Crop Year	272,777,516	250,406,233	22,371,283
1970-71 Crop Year	91,105,890	67,480,825	23,625,065
	$953,269,590	$905,503,560	
Balance to be refunded by Producers as at July 31, 1971			47,766,030
Add:			
Bank interest to July 31, 1971 payable by the Government of Canada		36,262,236	
Less: Amount paid to July 31, 1971		35,969,761	292,475
			48,058,505
Deduct:			
Balance of funds received to cover advance payments in default:			
Government of Canada		76,025	
Line Elevator Companies		8,447	
Interest received on default payments		401,724	486,196
Owing to The Canadian Wheat Board as at July 31, 1971			$ 47,572,309

APPENDIX I

TABLE I-6

INCOME OF CANADIAN FARM OPERATORS FROM FARMING OPERATIONS, BY PROVINCE*

	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Canada(1)
	thousands of dollars									
1968										
1. Cash receipts(2)	34,476	55,026	49,034	636,814	1,318,823	364,660	893,114	799,939	204,615	4,356,501
2. Income in kind	5,677	7,706	6,741	70,919	171,289	38,086	77,612	80,277	33,296	491,603
3. Supplementary payments(3)	–	–	–	–	–	156	5,453	2,151	208	7,968
4. Realized gross income (1+2+3)	40,153	62,732	55,775	707,733	1,490,112	402,902	976,179	882,367	238,119	4,856,072
5. Operating and depreciation charges	33,982	45,486	44,783	512,102	1,088,429	289,171	610,844	580,996	144,936	3,350,729
6. Realized net income (4-5)	6,171	17,246	10,992	195,631	401,683	113,731	365,335	301,371	93,183	1,505,343
7. Value of inventory changes	2,408	484	987	2,267	– 12,067	48,578	96,760	62,085	3,211	204,713
8. Total gross income (4+7)	42,561	63,216	56,762	710,000	1,478,045	451,480	1,072,939	944,452	241,330	5,060,785
9. Total net income (8-5)	8,579	17,730	11,979	197,898	389,616	162,309	462,095	363,456	96,394	1,710,056
1969										
1. Cash receipts(2)	37,870	63,380	51,281	672,495	1,377,900	349,912	712,416	727,169	197,461	4,189,884
2. Income in kind	5,806	7,853	6,995	73,298	195,210	37,321	73,193	82,061	35,834	517,631
3. Supplementary payments(4)	–	–	–	–	968	497	5,913	2,429	128	9,935
4. Realized gross income (1+2+3)	43,676	71,233	58,276	745,793	1,574,078	387,730	791,522	811,659	233,483	4,717,450
5. Operating and depreciation charges	35,344	47,690	46,345	532,997	1,134,542	281,249	622,614	586,875	155,792	3,443,448
6. Realized net income (4-5)	8,332	23,543	11,931	212,796	439,536	106,481	168,908	224,784	77,691	1,274,002
7. Value of inventory changes	161	– 152	– 1,358	186	– 12,321	7,674	240,332	54,832	918	290,272
8. Total gross income (4+7)	43,837	71,081	56,918	745,979	1,561,757	395,404	1,031,854	866,491	234,401	5,007,722
9. Total net income (8-5)	8,493	23,391	10,573	212,982	427,215	114,155	409,240	279,616	78,609	1,564,274
1970										
1. Cash receipts(2)	44,575	64,934	57,472	666,029	1,382,643	333,978	688,408	691,862	209,095	4,138,996
2. Income in kind	5,715	7,713	6,810	74,684	198,103	35,241	68,988	80,160	38,203	515,617
3. Supplementary payments(5)	–	–	–	–	–	5,696	37,183	14,493	829	58,207
4. Realized gross income (1+2+3)	50,290	72,647	64,282	740,713	1,580,746	374,915	794,585	786,515	248,127	4,712,820
5. Operating and depreciation charges	36,893	49,485	47,286	559,055	1,175,857	283,263	600,745	585,609	165,653	3,503,846
6. Realized net income (4-5)	13,397	23,162	16,996	181,658	404,889	91,652	193,840	200,906	82,474	1,208,974
7. Value of inventory changes	425	135	122	14,028	– 2,768	– 7,194	14,114	43,515	3,155	65,532
8. Total gross income (4+7)	50,715	72,782	64,404	754,741	1,577,978	367,721	808,699	830,030	251,282	4,778,352
9. Total net income (8-5)	13,822	23,297	17,118	195,686	402,121	84,458	207,954	244,421	85,629	1,274,506
1971										
1. Cash receipts(2)	39,102	62,576	51,600	691,608	1,385,496	366,988	904,832	771,301	220,822	4,494,325
2. Income in kind	5,440	7,114	6,050	70,854	209,778	33,617	66,176	77,375	39,102	515,506
3. Supplementary payments(6)	–	–	–	..	–	5,572	6,810	5,633	240	18,255
4. Realized gross income (1+2+3)	44,542	69,690	57,650	762,462	1,595,274	406,177	977,818	854,309	260,164	5,028,086
5. Operating and depreciation charges	36,904	50,950	47,589	587,144	1,247,753	300,845	626,399	610,994	179,748	3,688,326
6. Realized net income (4-5)	7,638	18,740	10,061	175,318	347,521	105,332	351,419	243,315	80,416	1,339,760
7. Value of inventory changes	– 1,026	– 950	509	5,767	– 22,941	53,092	133,390	54,781	11,344	233,966
8. Total gross income (4+7)	43,516	68,740	58,159	768,229	1,572,333	459,269	1,111,209	909,090	271,508	5,262,052
9. Total net income (8-5)	6,612	17,790	10,570	181,085	324,580	158,424	484,809	298,096	91,760	1,573,726

(1) Excludes Newfoundland. (2) Cash Receipts from Farming Operations. (3) Payments made under the provisions of the Prairie Farm Assistance Act. (4) Payments made under the provisions of the Prairie Farm Assistance Act and payments made by the federal government to eligible sugar beet growers, following closure of the sugar beet refinery in south-western Ontario. (5) Payments made under the provisions of the Prairie Farm Assistance Act and payments made under the Lower Inventory for Tomorrow (LIFT) program. (6) Payments made under the provisions of the Prairie Farm Assistance Act, payments made under the Lower Inventory for Tomorrow (LIFT) program and payments to Manitoba farmers under the Farm Acreage Payment program.

* Source: Ref. 45.

APPENDIX I

MEASURES OF FARM INCOME ARE MISLEADING: REPORTED LEA

CURRENT FARM INCOME POSITION

"Various measures of farm income available from the Alberta Department of Agriculture, Alberta Bureau of Statistics and Statistics Canada can be misleading," cautioned Dobson Lea, President of Unifarm.

Mr. Lea presenting Unifarm's annual brief to the Provincial Cabinet October 28, unveiled the organizations proposed solutions to the many problems facing farmers.

Noting that the government has gone on record as being concerned and determined to challenge these problems, Mr. Lea commented that "We look forward to increasing consultation and co-operation with the new government."

Unifarm feels that it is extremely important that the current income position of Alberta farmers is understood before attempts are made to solve the many problems facing them.

The measure most often used is based on gross cash receipts to which Income in Kind is added, and from which farm operating expenses are deducted to establish "realized net farm income".

TABLE I

INDIVIDUAL TAXATION – STATISTICS, ALBERTA FARMERS 1966-69

Net Income Class	1966	1967 (number)	1968	1969	1970
Individual Taxable Returns					
Under $2,000	3,205	2,716	2,610	2,756	2345
2,000 to 3,000	4,490	4,380	4,521	4,190	3750
3,000 to 4,000	5,290	4,985	5,195	4,901	4285
4,000 to 5,000	4,490	4,107	4,281	3,820	3175
5,000 to 7,000	5,194	5,365	5,638	4,532	4150
7,000 to 9,000	2,610	3,031	3,313	2,100	1930
9,000 to 15,000	2,850	3,417	3,264	2,331	2175
15,000 and over	932	1,091	1,102	705	705
TOTAL	29,061	29,092	29,924	25,335	22345
AVERAGE INCOME $	5,440	5,780	5,740	5,270	5381
Non Taxable Returns					
Under 2,000	19.064	20,309	19,774	22.636	24276
2,000 – 3,000	6.721	5,782	6,615	5,180	5220
3,000 and over	3,804	3,353	2,872	2,757	3,139
TOTAL	29,589	29,444	29,261	30,573	32635
AVERAGE INCOME $	1,460	1,200	1,200	750	729
All Individual Returns					
Under 1,000	11,209	12,360	12,078	15,171	16471
1,000 – 2,000	11.060	10,665	10,306	10,221	10150
2,000 – 3,000	11,211	10,082	11,137	9,370	9170
3,000 – 4,000	7,657	7,078	6,875	6,764	6350
4,000 – 5,000	5,200	4,707	4.881	4.160	3616
5,000 and over	12,313	13,564	13,909	10,222	9583
TOTAL	58,650	58,456	59,185	55,908	55350
AVERAGE INCOME $	3,500	3,470	3,440	2,800	2640

Source: Unpublished data, Department of National Revenue, Ottawa.

"New farm income" can be calculated by adding inventory changes. However, neither of these is by any means a measure of disposable income. Unifarm believes that disposable net family income is a more meaningful measure of the economic well-being (excluding social benefits or requirements) of the family farm.

The best available measure can be taken from taxation statistics, which report all income whether it is from the farm only or from the farm and other sources. These statistics do not include imputed "Income In Kind" ($82.2 million in 1969, or which $61.4 million represents house rent) but "Income In Kind" representing the value of home-grown food consumed is included.

TABLE I shows that of 55,908, who filed returns, 30,573 farmers were non-taxable. This indicates that approximate-

(continued on page 4)

PRESIDENT REPORTS TO CONVENTION

The validity of post secondary education interspersed by periods of employment, was questioned by the president of the Women of Unifarm, Mrs. Elizabeth Pedersen.

Presenting her annual report to the convention, held November 9th and 10th at the MacDonald Hotel in Edmonton, Mrs. Pedersen posed several pertinent questions with regard to traditional education.

– "With the adoption of the 'open door' policy at the Canadian universities, have we committed ourselves to unnecessary public expenditures?"

– "In the interests of economy should we be discussing the advantages and disadvantages of Regional Rural High School?"

– "By using a revised semester schedule, staggering classes and teaching staff, could we maximize the use of our expensive educational facilities?"

Several of the convention's resolutions centered around Mrs. Pedersen's review of the Status of Women Report, the interim report of the LeDain Commission on the Non-medical Use of Drugs, and the report of the Associated Country Women of the World, the international organization with which Women of Unifarm is affiliated. (See page 6 convention resolutions).

Farm Trends - Page 3 - November, 1971

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(continued from page 3)

ly 55 per cent of Alberta farmers were at, or below the poverty line in 1969. Their average net family income was $750. The average for all farmers who filed returns was approximately $2,800 (not including incorporated farms which would increase the average). This average is down from $3,500 in 1966. At the same time the percentage of taxable returns dropped from 50 per cent in 1966 to 45 per cent in 1969.

The number of farm returns filed in 1969 dropped to 55,908 from 59,185 the previous year. Unifarm has attributed this decrease to:

a) decrease in farm numbers.

b) reclassification of some individuals because gross sales from farming had dropped below income from other sources.

c) some had incorporated their farms.

d) many had such low incomes that they were not compelled to file a return. (Taxable returns filed dropped by 4,859, and non-taxable returns increased by 1,312).

That 74 per cent of the unincorporated family farms earned less than $4,000 net family income in 1969 indicates the economic position of Alberta's farm community. (The average for this group is only $1,800).

Comparable statistics for 1970 are not available but Dominion Bureau of Statistics reports that realized net farm income is lower by $22 million over 1969, while our projected forecast for 1971 indicates that the average net farm family income will be very close to the figures reported herein for the taxation year 1969.

TABLE II shows that farmers have been reporting more off-farm income while net farm income has been dropping. Farm income accounted for 81 per cent of family income in 1962 and only 68 per cent in 1969. This is due to the decrease in farm income.

TABLE II
SOURCES OF INDIVIDUAL INCOME, ALBERTA FARMERS
1962 - 1968 and 1969

ALL TAX RETURNS	1962	1968	1969	1970
	Millions of dollars			
Farming Income	110.5	155.2	106.6	89.4
Per Cent	81	75	68	61.1
Wages and Salaries	11.2	24.5	21.9	23.5
Per Cent	8	12	14	16.1
Bond & Bank Interest	4.6	12.1	13.5	16.9
Per Cent	3	6	9	16.3
Other	8.8	15.7	14.6	16.3
Per Cent	8	7	8	11.1
TOTAL INCOME	135.1	207.5	156.6	146.2

Source: Unpublished data, Department of National Revenue, Ottawa.

CHURCHILL SETS NEW RECORD

A new export record for the Port of Churchill was set last night when the 17,000 ton Hallendrecht cleared with about 600,000 bushels of wheat in her holds.

Bound for Rotterdam, the Hallendrecht was the last vessel to load export grain at Churchill this year and brought total grain clearances to a new high of approximately 25.5 million bushels for the season. The previous record of 24.7 million bushels was set in 1965.

A total of 36 vessels were involved in the Churchill movement this year. Starting with the Tamworth which cleared the port August 7, twelve of these vessels were bound for the United Kingdom, 11 to India, five to Belguim, four to Holland, two to Italy and one each to Norway and Iraq. A coastal vessel, due at Churchill today, will pick up the screenings which accumulated during this year's operations.

A total of 4.9 million bushels of barley were cleared through Churchill this year. This was the first time a second grain was involved in the Churchill movement and as a result of the experiment, it is the intention of the Wheat Board to move substantial quantities of barley through the northern port next year.

"With the short season that we have at the port, the Churchill movement always required a lot of careful planning and close co-ordination between the country elevator companies, Canadian National Railways, the Canadian Grain Commission and government terminal," said C.A. Gusberti, the Wheat Board's General Director of Sales. "Yet, despite the added problem of handling barley through the terminal, we had no difficulty in meeting our sales commitments at the Port."

More than 12,200 carlots of grain were required for the Churchill movement this year. Wheat stocks in the terminal will reach just over one million bushels when the last grain cars arrive at Churchill in a few days. The balance needed to fill the terminal will be moved early next summer when the exact kinds and quantities of grain needed for shipment at the start of the 1972 season will be known.

"It is essential to ensure that the grain in the terminal at the start of a new season is the kind and grade of grain that is needed when the first vessels arrive," said Mr. Gusberti. "This is particularly important now that Canada's wheat grades are being sold on a protein basis. Unless we gear rail shipments to Churchill to the arrival of vessels, it would be virtually impossible to maintain shipments through this port at a maximum level."

HOPPER CARS ENTER SERVICE

Hopper cars, used primarily for transporting potash, have proved excellent for grain shipment. While used occasionally for some time, it has only been in the last couple of years that they have been used to any extent. Hopper cars have been found to have many advantages, such as eliminating having to break the six foot grain doors, and simplifying loading and unloading. They can only be used where grain elevators have high grain spouts, and railroad tracks must be able to support combined grain and car weight – sometimes as high as 220,000 pounds.

FARM TRENDS

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EDMONTON DEMOGRAPHIC PLOTS

The following eight semi-logarithmic plots of students and population for selected Edmonton 1966 census tracts, are representative samples from The Population and University Student Neighbourhood Generation Cycle for the City of Edmonton. Also the plots for the satellite communities of St. Albert and Sherwood Park are included.

Note that the use of semi-logarithmic graphs allows the comparison of numbers of two widely separated scales (40), those of population and students. The plots show, in general, that recorded resident Edmonton university student growth is most similar to the growth of the 15 to 24 year population, by way of comparable curve slopes. Registrars' Statistics (35, 36, 37) from the three Alberta Universities, show by way of student age profiles that the above graphical determination is reasonable.

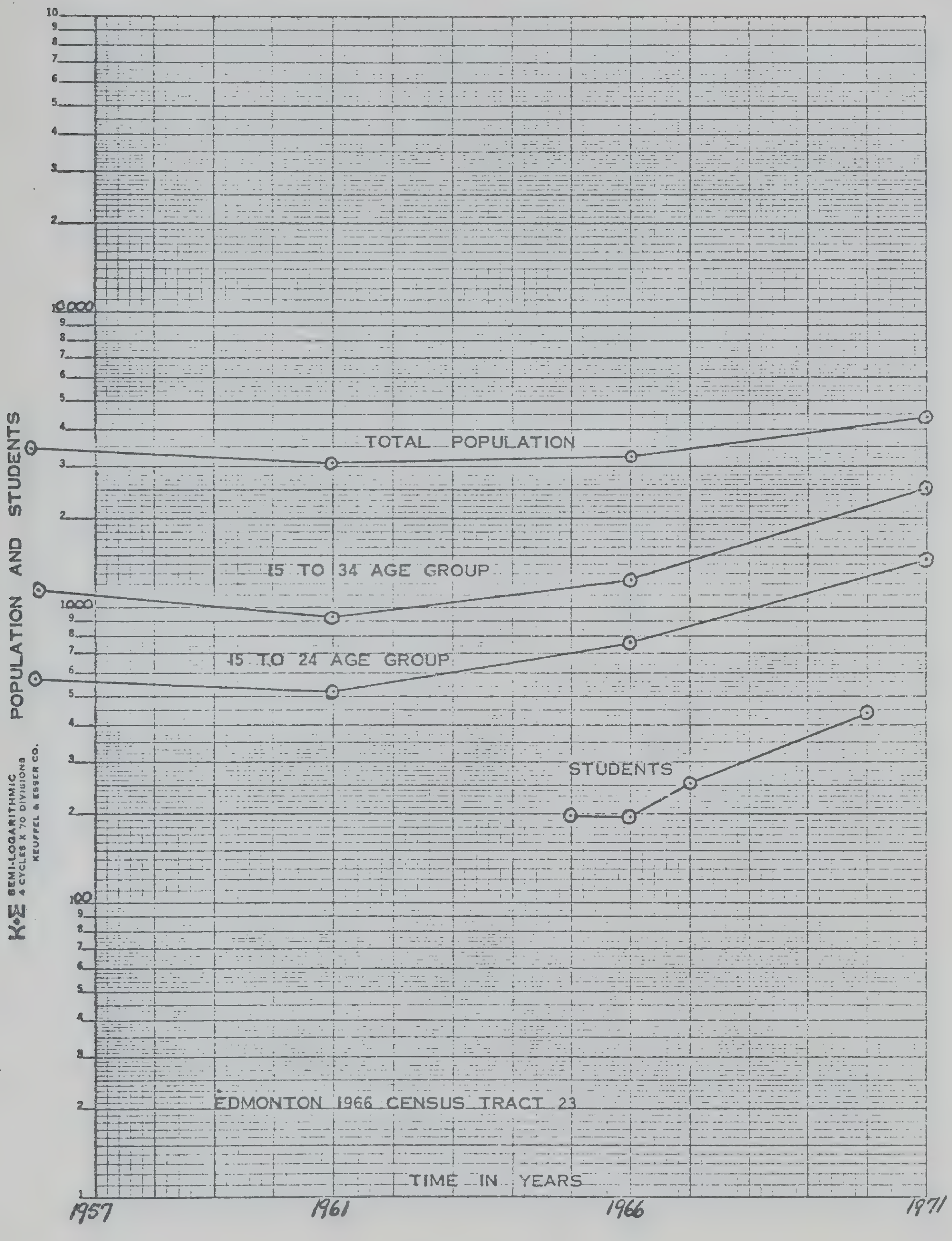

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FIGURE 1.5. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE

SAMPLE OF STAGE 1 (Ref. FIGURE 2.3)

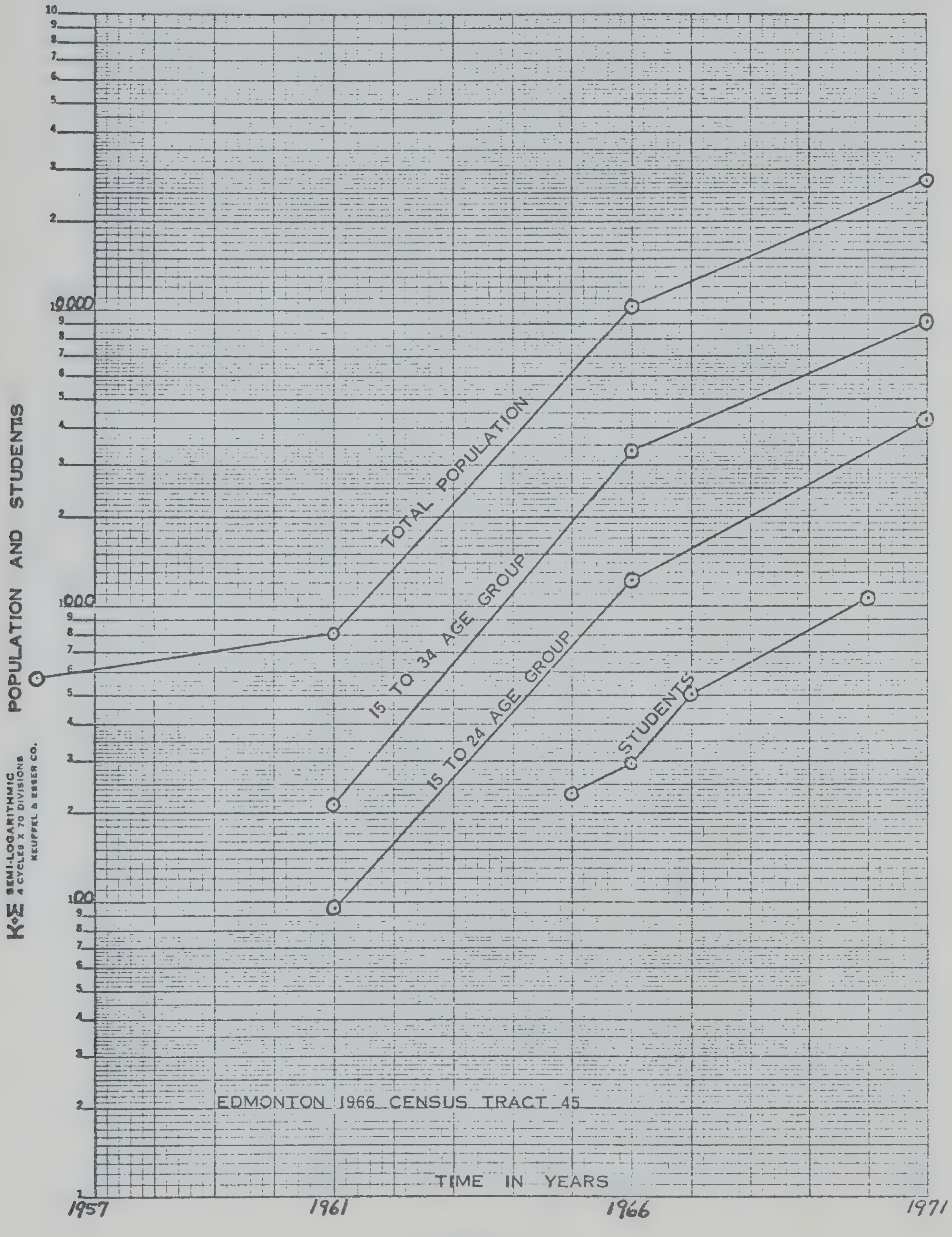

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FIGURE 1.6. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE SAMPLE OF STAGE 1 (Ref. FIGURE 2.3)

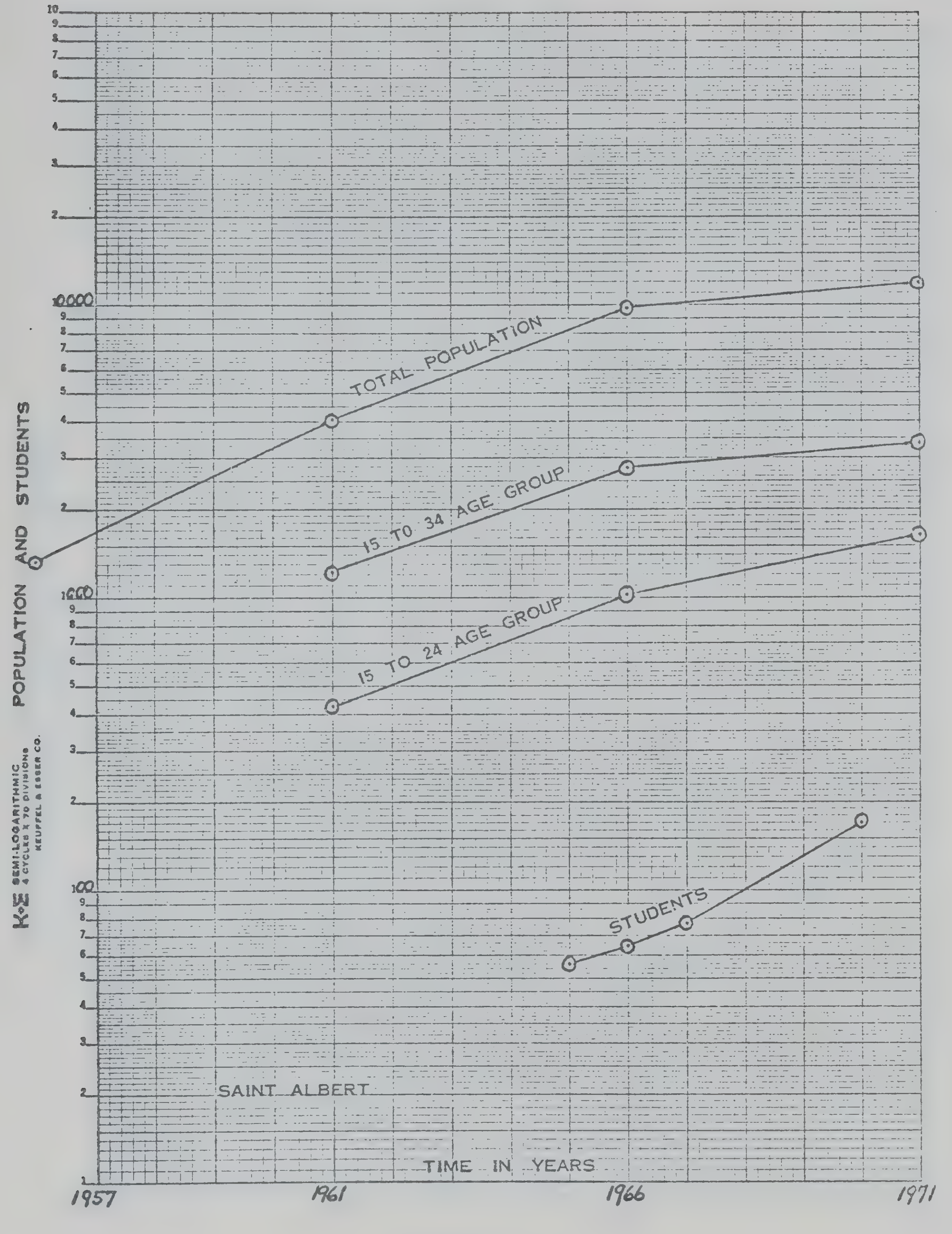

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FIGURE 1.7. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE SAMPLE OF STAGE 1 (Ref. FIGURE 2.3)

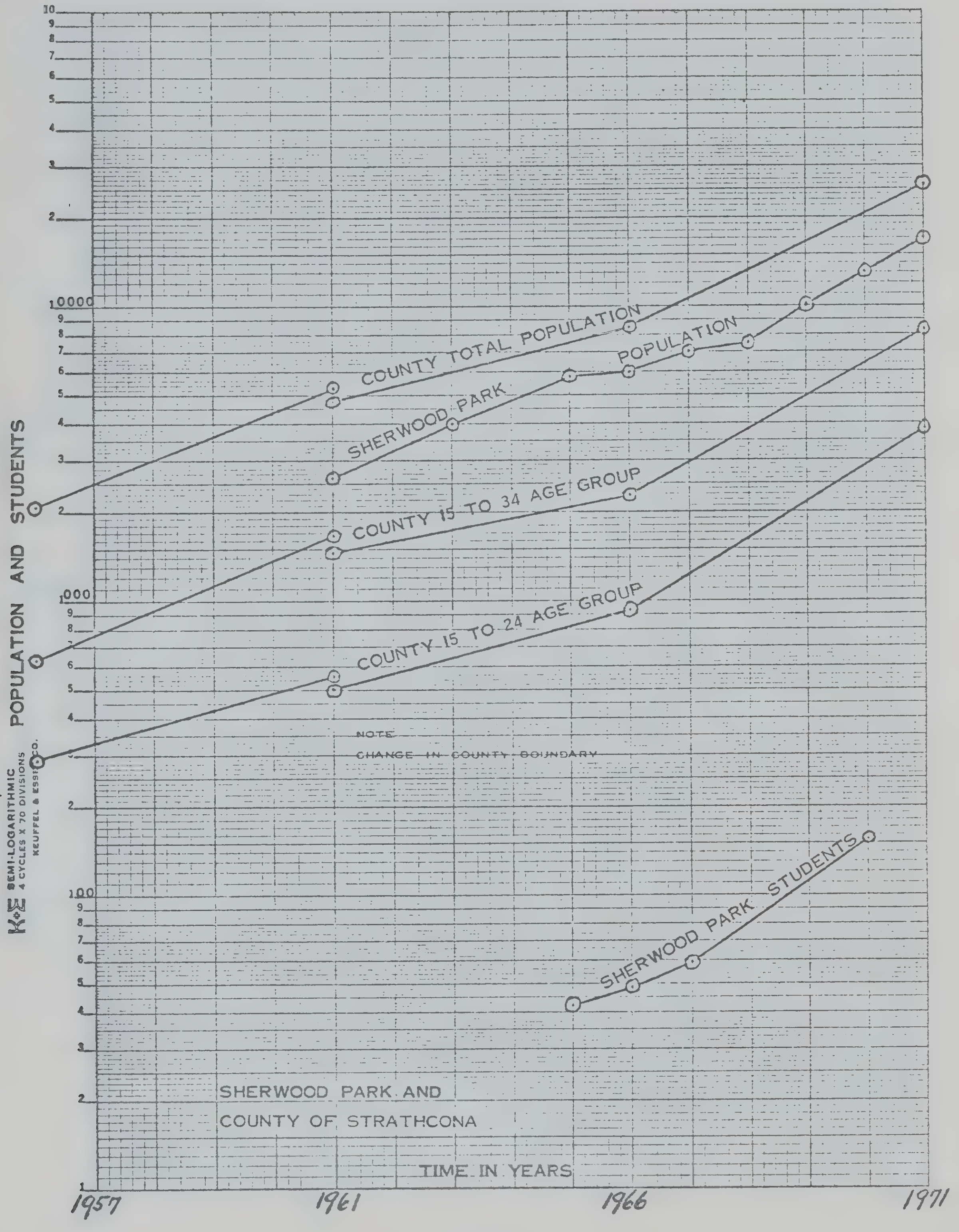

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FIGURE 1.8. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE SAMPLE OF STAGE 1 (Ref. FIGURE 2.3)

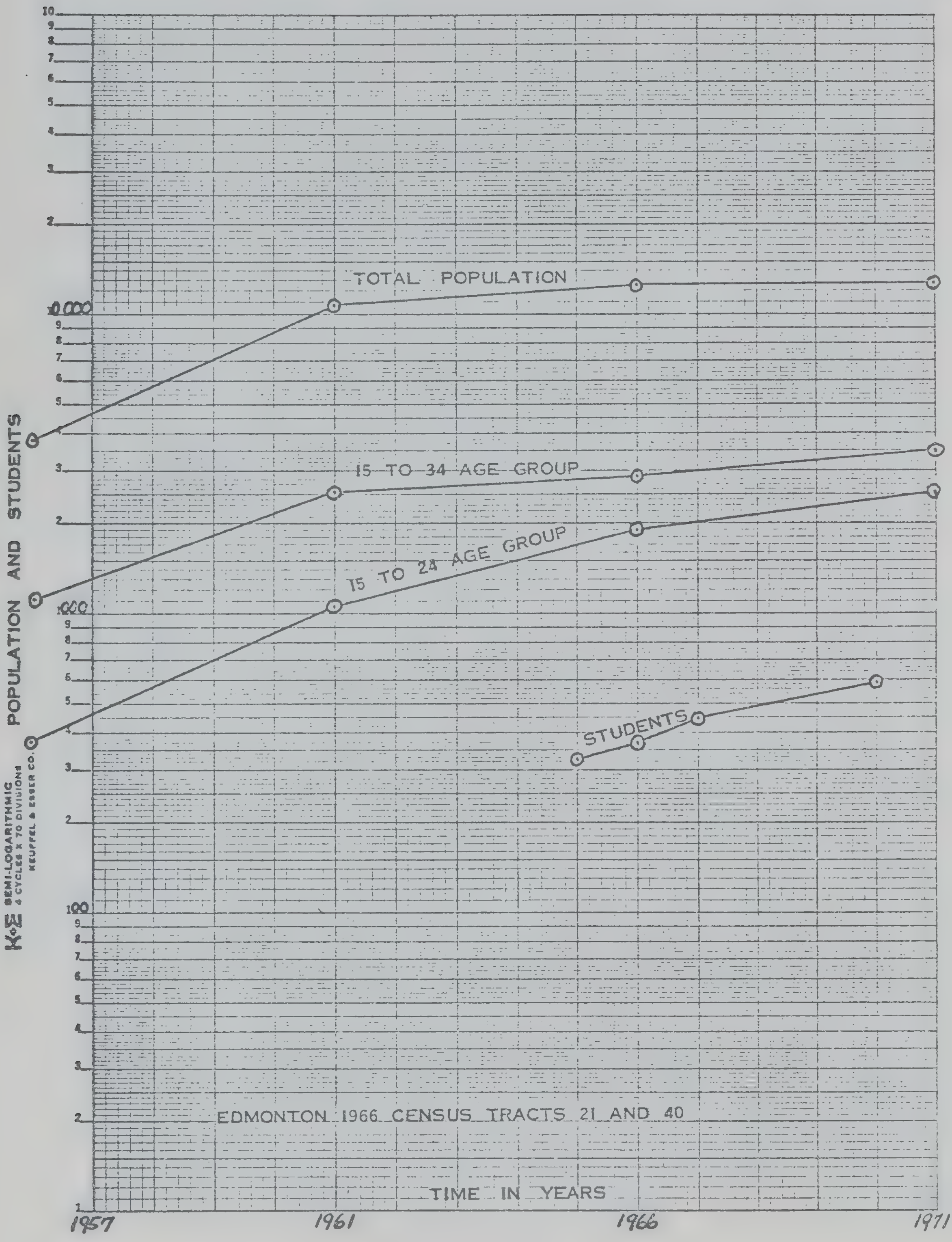

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FIGURE 1.9. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE SAMPLE OF STAGE 2 (Ref. FIGURE 2.3)

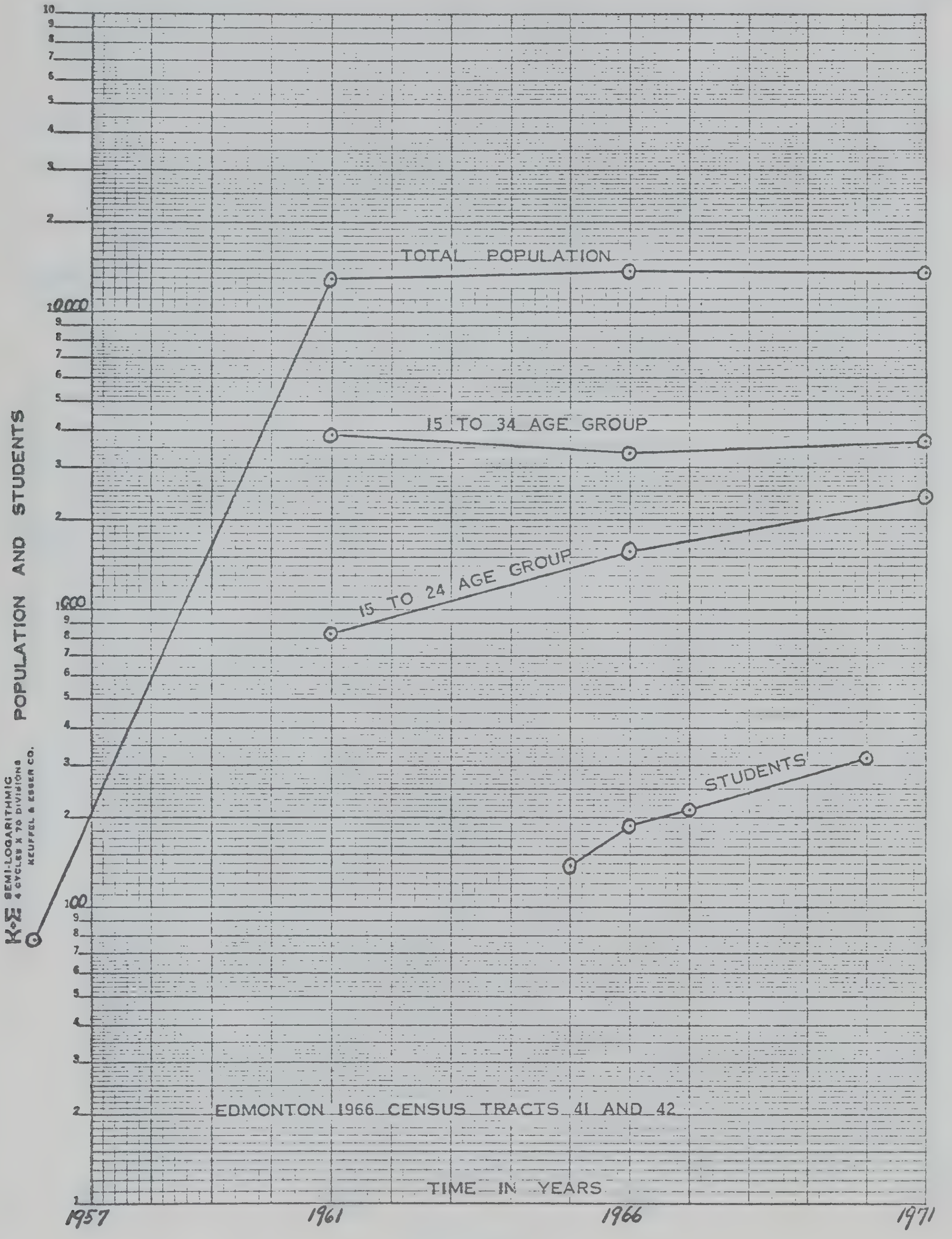

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FIGURE 1.10. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE SAMPLE OF STAGE 3 (Ref. FIGURE 2.3)

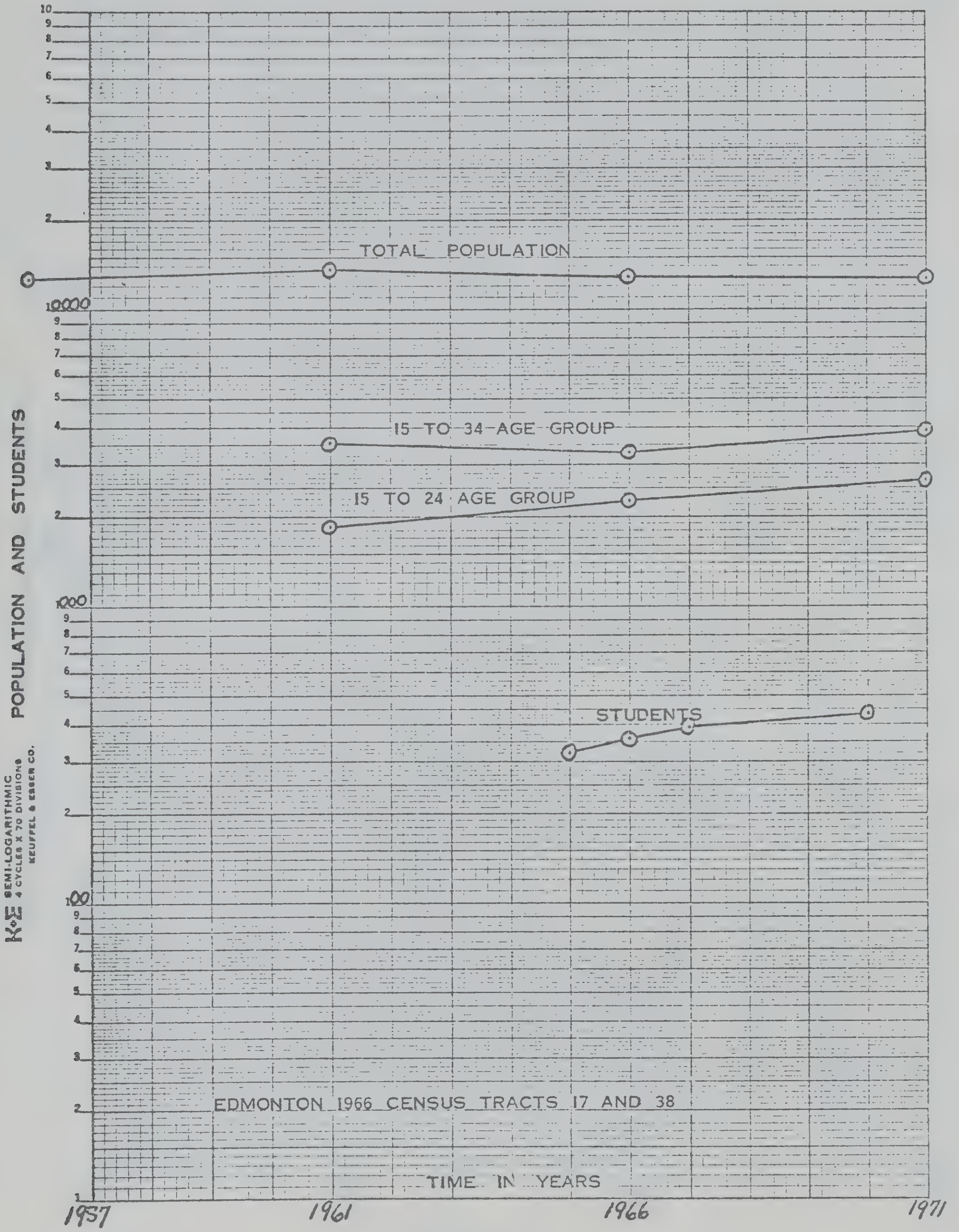

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FIGURE 1.11. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE SAMPLE OF STAGE 4 (Ref. FIGURE 2.3)

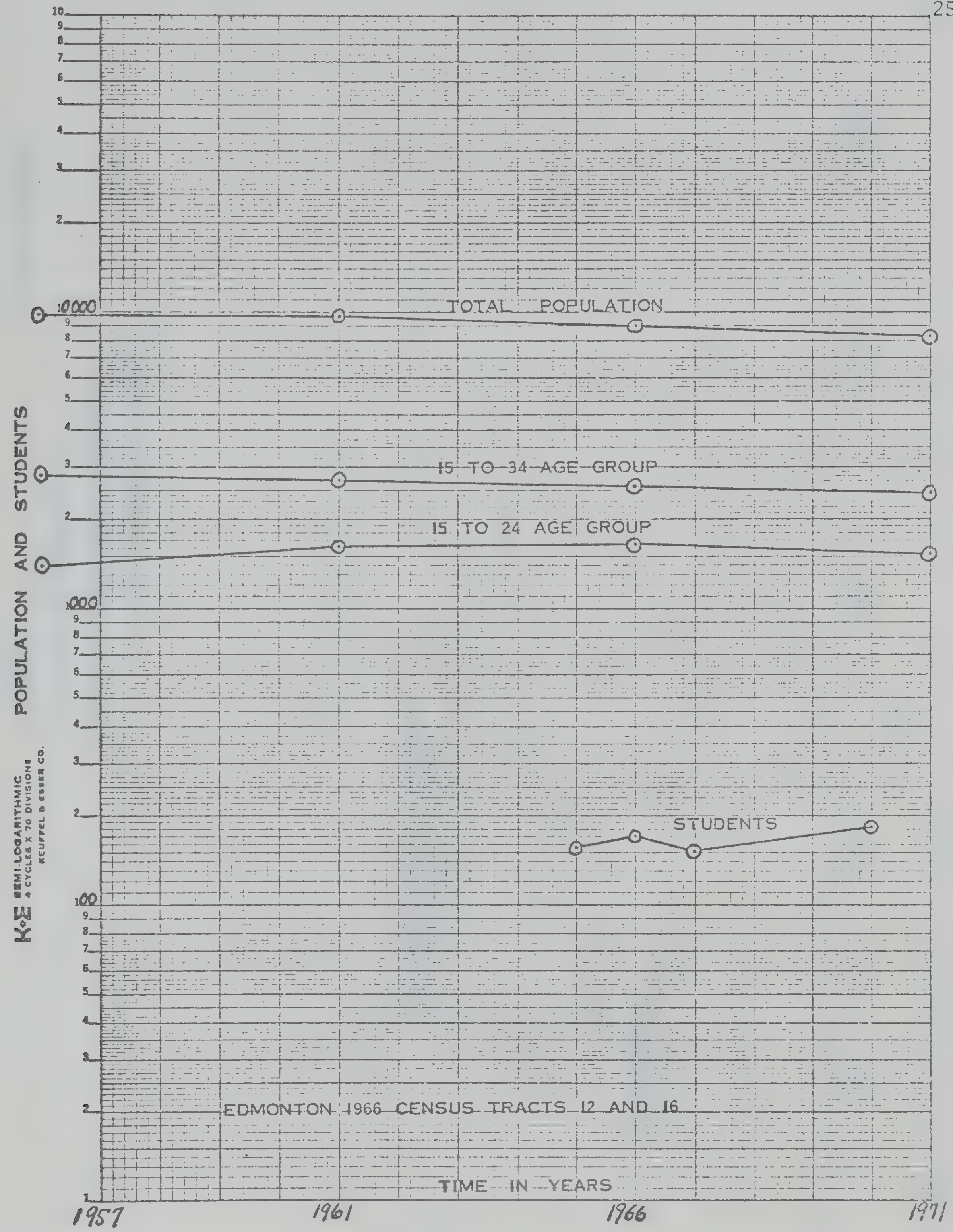

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FIGURE 1.12. THE UNIVERSITY OF ALBERTA POPULATION AND UNIVERSITY STUDENT NEIGHBOURHOOD GENERATION CYCLE SAMPLE OF STAGE 5 (Ref. FIGURE 2.3)

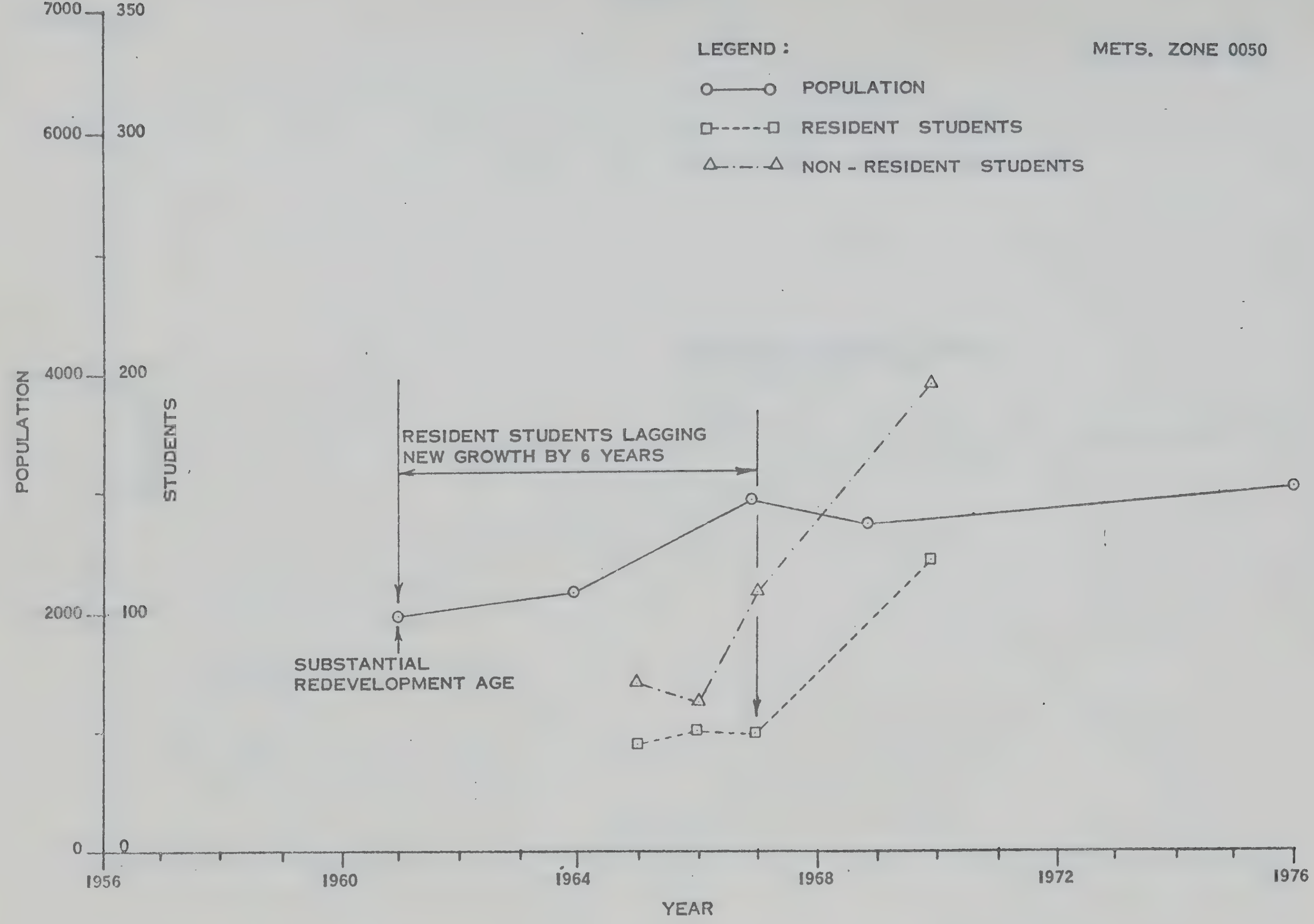

FIGURE 1.13. METROPOLITAN EDMONTON METS ZONE 0050 STUDENT LAG FACTOR (Years)

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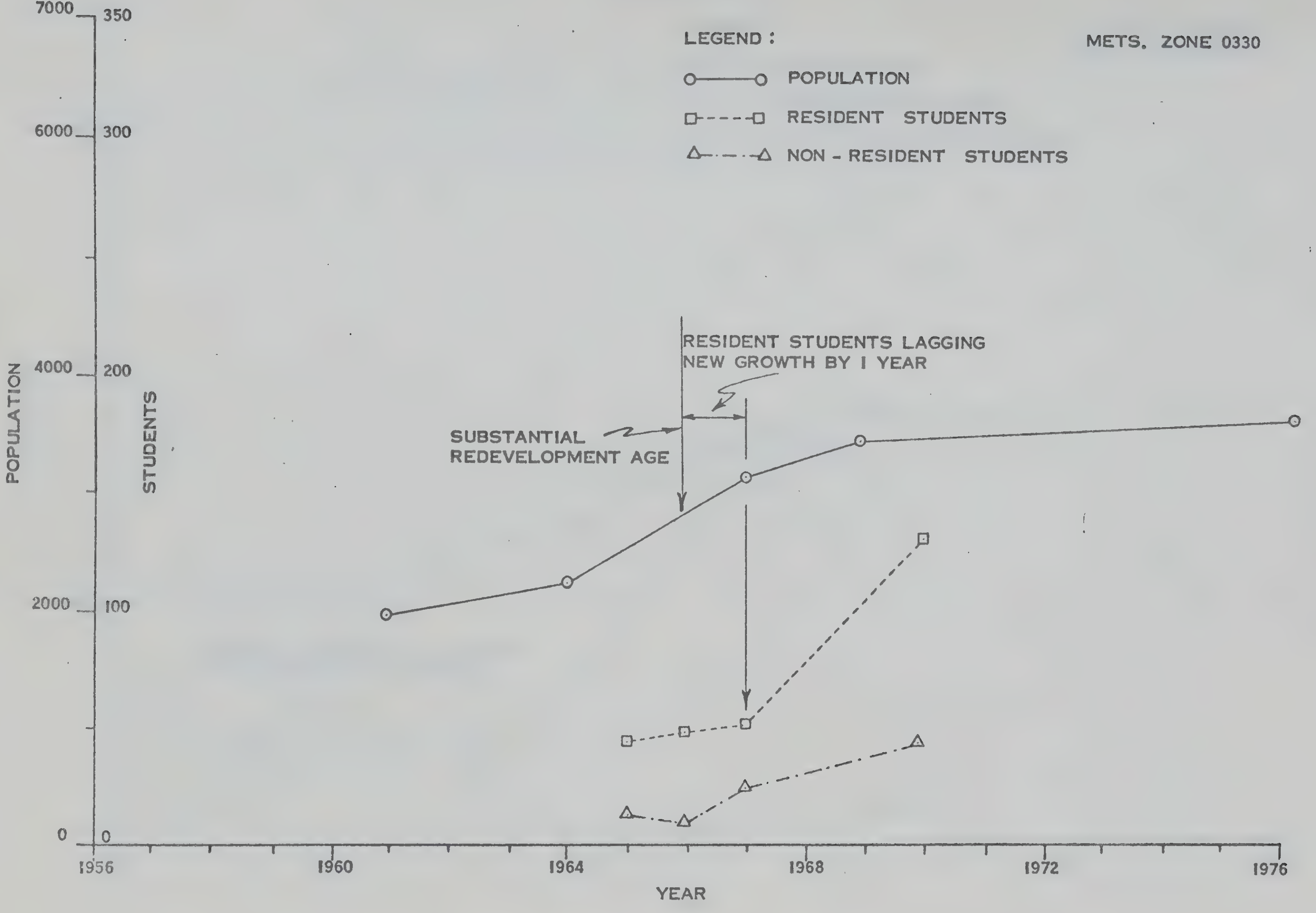

FIGURE 1.14. METROPOLITAN EDMONTON METS ZONE 0330 STUDENT LAG FACTOR (Years)

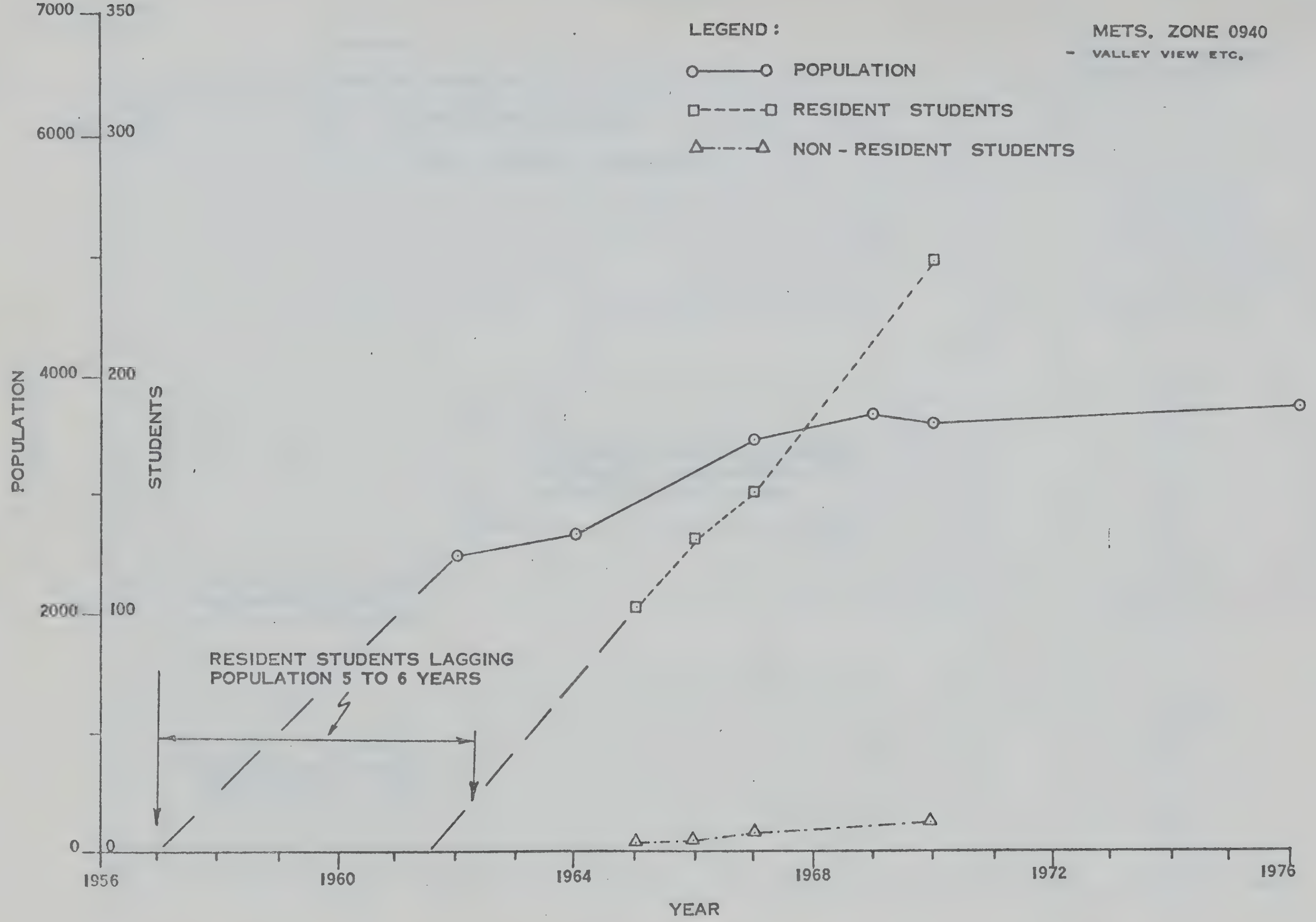

FIGURE 1.15. METROPOLITAN EDMONTON METS ZONE 0940 STUDENT LAG FACTOR (Years)

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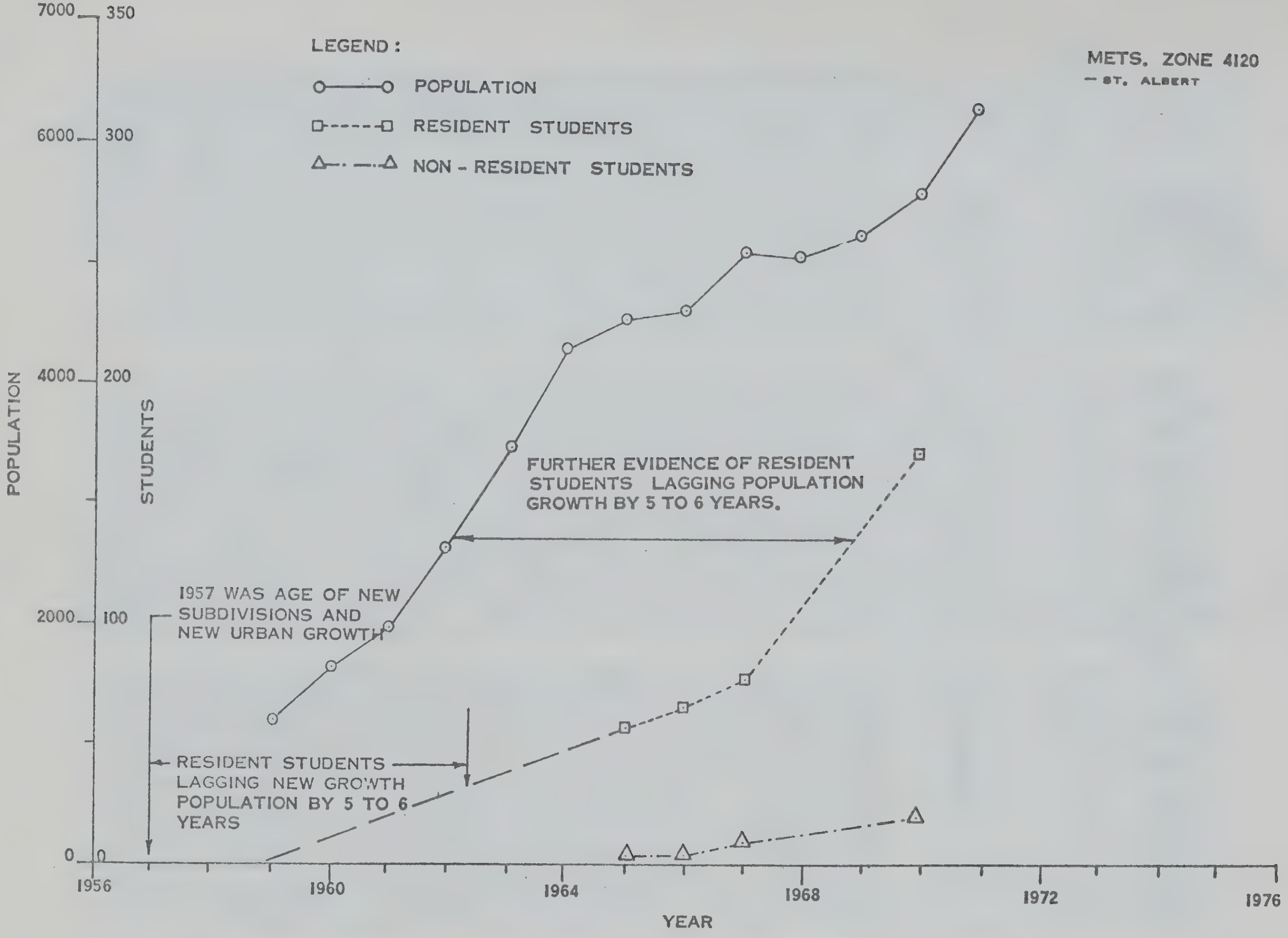

FIGURE 1.16. METROPOLITAN EDMONTON METS ZONE 4120 STUDENT LAG FACTOR (Years)

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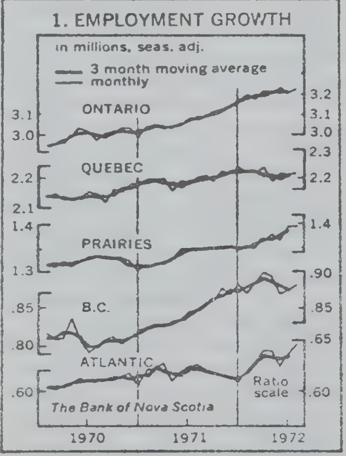
Monthly Review
THE BANK OF NOVA SCOTIA
Toronto
August 1972

The Economic Upswing in Canada—A Regional Survey

The current Canadian business expansion, which has had to withstand a good many uncertainties since it first began to take shape at the start of 1971, has now gathered more definite momentum. Production and sales have been moving ahead strongly, and as the realities of an improving business trend have become more widely recognized, the hesitancy in Canadian business circles has gradually disappeared. In particular, of course, the misgivings expressed last fall about possible adverse effects from the special U.S. corrective measures of August 15th have since been muted by the emergence of a very convincing recovery in U.S. production and the continued strong growth of Canadian exports to the U.S. market.

It is true that international currency conditions have remained unsettled (and this condition will undoubtedly persist until there is more substantial evidence of improvement in the U.S. payments position) but business concern on this score was clearly relieved by the Smithsonian currency realignment of last December; and confidence has been further strengthened by the quick official response to pressures on sterling, and by helpful policy developments in Europe and Japan as well as in the United States. Indeed, the fact that a business revival has been emerging in these major countries on the heels of the pick-up in North America must be counted as a plus from the point of view not only of Canada's own immediate export prospects but also of the emerging world trade and payments situtation generally.

Against the improved international setting, the Canadian trend this year has continued to rise at slightly above the country's medium-term potential rate of growth. Consumer spending has gained in strength, with notable increases in cars and other durables: the surge of housebuilding has managed to retain its force for somewhat longer than anticipated; and total exports so far this year have also run surprisingly strongly, considering that a low point in exports to overseas countries was reached in the first quarter. In large part because of the deterioration in the merchandise trade balance through last winter, (the result of the temporary sag in exports and a simultaneous bulge in imports spurred on by exchange rate considerations) the uptrend in Canadian production gave some appearance of hesitancy in the fourth quarter of 1971 and the first quarter of this year. In subsequent months, however, the rate of growth has strengthened appreciably again, with gains in external trade and retail sales outweighing the disruptions of several strikes.


1. EMPLOYMENT GROWTH

The Bank of Nova Scotia

The ebb and flow in production has been reflected only in a broad sense in the labour market. Total employment has, of course, pointed upwards and through the April-July period was 3½% higher than a year earlier. The trend, however, has been a little irregular, and reported additions to the labour force have been both large and variable. An additional complication has probably arisen from the broader availability of unemployment insurance. The recorded rate of unemployment thus has not improved as much as had been hoped, though the average of 6.1% (seasonally adjusted) for the April-July period was better than the 6.4% of a year earlier. As Chart 1 shows, the gains in employment over the past year have not been evenly spread across Canada; Ontario has made the most consistent advance, but the trend in several other regions, and especially in Quebec and British Columbia, has been affected by special conditions, particularly major work stoppages. Indeed, with a heavy calendar of collective bargaining this year, industrial disputes in Canada have been widespread.

The emerging pattern of labour settlements, moreover, has brought very little moderation in the trend of wage increases; and while wage gains almost

certainly have been contributing to the large advances in consumer spending, they have also kept substantial upward pressure on costs and prices (in notable contrast to the recent trends in the United States). While it is thus disappointing that the Canadian price trend has shown such a limited moderation through the recent period, it must be hoped that some restraining price influences will work through, both from a still-slack labour market, and from the improved wage-price performance in the United States—particularly if this can be kept up next year.

For more than two years now, the thrust of official economic policies has been decidedly expansive and aimed primarily at encouraging needed growth in jobs. As in the United States, budgetary policy has included both tax reductions and successive step-ups in selected expenditure programs—the latest Canadian budget, in May of this year, providing added pension payments and new inducements to business capital outlays, especially in manufacturing and processing facilities. In the monetary sphere, moreover, the Canadian authorities have for much of the past two years felt compelled to stretch their views as to appropriate rates of credit expansion because of the desire to avoid undue upward pressure on the exchange rate through attraction of external funds. The overall policy thrust has clearly contributed to the spreading upswing in business activity, and with the U.S. economy now also well established on a strongly expansionary course, the pattern for the coming year is already shaping up on lines of further strong general expansion and of gradually strengthening business investment. Policy concern, accordingly, is beginning to shift in the direction of slightly moderating the degree of official stimulus, both because of the persisting speed of cost-price advance and because of the dangers of moving into another phase of excessive and unsustainable expansion. As in the past, however, it will still be a challenge to foster a wide regional spread of the growth that is in prospect for the period ahead.

The Atlantic Region

The business trend in the Atlantic Provinces, while clearly pointing upwards, has not shown the same sustained push that has been apparent in some other parts of the country. The recovery through 1971 relied heavily on an increase in service activities (including government) and the employment trend sagged noticeably in the second half of the year. This year, expansive forces have been somewhat broader in scope and through the April-July period total employment was 2.8% higher than a year ago, or somewhat below the gain shown for the country as a whole. At the same time, participation in the labour force (especially by young persons) has picked up to an unusual extent so that the regional unemployment rate, after holding down encouragingly through the winter and early spring, has not improved as much as usual into the summer period (so going appreciably above the year-ago level).

The rising production trend which has accompanied the improvement in employment has been linked largely to better export markets for some of the Atlantic Provinces' basic products. Manufacturing shipments in Newfoundland, Nova Scotia and New Brunswick were over 10% higher in the first six months of this year compared with a year ago. The forest products industry has clearly contributed to this revival, particularly in New Brunswick where several new pulp and paper facilities have been coming on stream and where lumber production has been stronger. Nova Scotia's manufacturing output has accelerated in line with the general business expansion; the new truck tire plants have been moving into operation at a time when North American truck production has been running very strongly, and the small automotive assembly plants in the province have been increasing their output. Production of heavy water has now started at one of the new plants, and the equipping of the offshore oil industry is giving a new boost to the region. Oil refining, too, has increased noticeably.

Mining operations in the region have begun to improve, particularly in the case of copper, lead and zinc in New Brunswick. Iron ore shipments out of Labrador, while still showing declines through the early part of this year, appear now to be firming, in line with the steady disappearance of excessive inventories in the United States. Farmers' cash receipts have moved up this year, with good gains in livestock offsetting a decline in revenue from the specialized potato crop. The volume of fish landings, however, has declined drastically as a result both of diminishing ocean stocks and unfavourable catching conditions, and higher prices have only partly compensated for the drop.

Construction activity is increasing this year in all the Atlantic provinces except Newfoundland, where several major projects, including the big Come-By-Chance oil refining complex, the Stephenville linerboard plant and the Churchill Falls power project are in various degrees approaching completion. In New Brunswick, work is starting on a major oil terminal and a new oil-fired generating station at Lorneville, while in Nova Scotia, the new tire production facilities are now being enlarged to include output of car tires. Across the region, both new housing work and new government and institutional building are advancing further this year.

Province of Quebec

Quebec has experienced a stronger business environment over the past year and a half, but this has not yet yielded the desired increase in employment. Over the past twelve months, indeed, the number of people at work has increased by only about 1%, and even though the labour force growth in the province has been quite modest, the rate of unemployment (seasonally adjusted) has been moving upwards again since the spring. Some allowance must be made, however, for the serious impact of strikes, firstly involving government workers in the spring and then affecting port workers and some others during the summer. The disappointing employment situation also fails to reflect the improving tone of business sentiment, which is being exhibited both by a strong retail sales performance (with an increase of 12.2% in the first half of this year about matching that on the national level), and by an indicated major step-up in capital investment this year.

Most of Quebec's key industries have now begun to taste some degree of improvement. Newsprint shipments have moved up strongly, in line with the pick-up of sales to the U.S. market,

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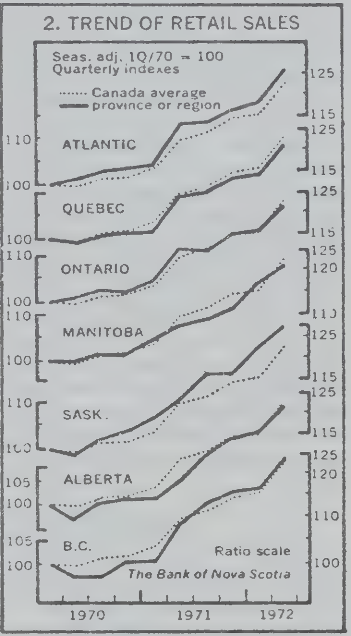
while the sustained expansion of North American housebuilding has been supporting production of asbestos, cement and lumber. The copper market has been recovering slowly, and the situation here, as in iron ore and aluminum, stands to be improved by the emerging strong expansion of the U.S. economy. For many of the province's manufacturing industries, the recent upswing in consumer spending has been an encouragement; this has been particularly evident in furniture and appliances, and has shown up to some extent also in textiles and shoes, although producers in these lines have continued to face serious import competition. The chemical industry, also troubled in this way, has been slow to recover. In contrast, the revival of business aircraft sales in North America has boosted local production of aircraft engines, while a similar impetus for the electronics industry has been derived from the expansion of telecommunications services.

Construction in the province is going through a major expansionary phase; alongside the general quickening of housebuilding there are several key areas of new investment, and the mid-year investment survey suggested a 17% gain in total investment outlays this year. Expenditures on resource-oriented projects are by far the most important and include the major expansion of iron-ore developments near the Quebec-Labrador border, several nickel and copper processing facilities, as well as the continued outlays on asbestos mining and fabricating plant. The construction at Port Cartier of a large pulp mill is now well underway. It is also significant that public and commercial building is moving up strongly. Meanwhile, for the longer run, substantial outlays remain to be made on the Manicouagan-Outardes hydro project, and preliminary work on the James Bay Development has already started.

Province of Ontario

The quickening of the business pace in Ontario, evident throughout 1971, has received a significant boost this year. While the early elements of the strengthening have remained intact—notably housebuilding and consumer spending—the province has for the past twelve months also been experiencing a marked upturn in its overall manufacturing production and export sales. Thus employment has continued on a rising trend, and during the first seven months of this year the numbers employed averaged about 5% higher than during the first seven months of 1971, with the bulk of new jobs occuring in trade, services and some manufacturing industries. Such growth has brought about a distinct lowering in the rate of unemployment, the seasonally adjusted average of 4.6% for the first seven months comparing favourably with 5.2% for the whole of 1971.



2. TREND OF RETAIL SALES

A major feature of the Ontario business scene has continued to be the rapid expansion of housebuilding activity, particularly in the Toronto area, where commercial building is simultaneously going through a boom phase. The increasing number of house completions has also had a noticeable effect on sales and production of home appliances and electrical equipment.

As the strong trend of consumer spending generally has worked its way through into production schedules, and with U.S. demands also accelerating, manufacturing operations have shown sizeable gains. Motor vehicles and steel, key elements in Ontario's economic base, have both advanced further, although steel production eased off slightly during the summer, after the threat of strike interruptions disappeared. The new high levels of automotive production this year have owed a good deal to the spur given to U.S. car sales by the special measures of August, 1971. These benefits have far overshadowed the earlier doubts concerning the impact of the U.S. DISC legislation and of possible changes in the automotive agreement with the United States, although these remain uncertain areas for the period ahead. Demand for trucks has surged ahead this year, and the market for heavy machinery has also started to improve. Among other industries, pulp and paper, office equipment and consumer soft goods have all been showing gains, but difficulties still persist in the aircraft and chemicals industries.

Prospects in the mining sector took an upward turn at the beginning of the year after a very slack year in 1971 during which development plans in many areas, but especially nickel and copper, had to be noticeably curtailed in the face of soft world markets. This year, investment in mining is still cautious, but it appears that a gradual strengthening of demand is in progress; as a result, both mineral production and capital outlays may be stepped up toward year-end. The mid-year survey of investment intentions revealed that capital outlays in the manufacturing sector were also proceeding slowly, while the greater part of an expected 4.5% gain in overall capital expenditures this year will arise from housing, utilities and trade.

Farmers in Ontario, as in Quebec, have been realizing larger returns in most products this year (with total cash income in the first half of the year up roughly 15% over a year earlier). Crops in some localities have been damaged both by June frosts and later heavy rainfall, but replanting of the Ontario tobacco crop has been successful. Markets for hogs, cattle, eggs and milk have all been quite encouraging.

The Prairie Region

The business uptrend in the Prairies has been gaining considerable momentum, with agriculture—still the key common activity of the region—spear-

APPENDIX I

heading the advance. Markets for grains recovered substantially in 1971; and this year, with both grains and livestock enjoying improved market conditions, farm cash receipts are recording even larger gains. Near-record wheat exports along with much higher sales of barley brought overall grain shipments for the 1971-72 crop-year (ended July 31) to an unprecedented 791 million bushels, up from 672 million bushels in the previous year. Meanwhile, existing contracts with China and the U.S.S.R. virtually ensure that wheat shipments over the 1972-73 crop-year will continue at peak levels, notwithstanding the recent tie-up in the Port of Vancouver. Grain producers have benefited this year from two lump sum payments by the federal government—the first consisting of participation payments on grain delivered to the Wheat Board and the second being made under the two-price policy by which the federal government subsidizes domestic wheat sales for human consumption. In livestock, the major features have been the considerable improvement in hog prices from their low level of a year ago together with the strongly maintained demand for cattle.

With Saskatchewan still predominantly an agricultural economy, the strong growth in farm receipts is generating enough momentum to make it one of the more buoyant provinces this year. Retail sales, including farm equipment purchases, are moving exceptionally well (see Chart 2). Other sectors of the economy, however, continue to show steady but unspectacular growth. Capital outlays outside of agriculture are increasing only modestly, and manufacturing shipments likewise. Mineral output is also increasing slightly, and potash prices have been holding firm as the government has continued with its system of prorationing. Attempts to encourage more processing in the province, however, have met with only moderate success.

Economic activity in Manitoba is clinging closely to national trends. Manufacturing shipments in the first half of the year were up 11% on a year ago, with the wood and paper products, textiles and farm machinery industries showing particular strength. Mining has been beset by the softness of nickel and copper markets but conditions are now starting to improve. This is the first full year of production from the new Manibridge copper-nickel mine (100 miles east of Flin Flon). Capital outlays, which declined last year, are recovering strongly, helped both by a big expansion of work on power utilities and a step-up in institutional building.

Alberta is also enjoying good growth this year. Both primary and secondary industries have been faring well and the gains in retail sales and manufacturing shipments are exceeding those for Canada generally. Production of oil and gas has continued to increase strongly, and higher prices are augmenting the gains even more. Some of the added returns are to be diverted to provincial government revenues to support plans for diversifying industry in the province. Coal production is also experiencing substantial growth and, though problems remain, producers are now in a better position to fulfil their long-term contracts with Japan. Capital investment this year is increasing about in line with the national average; and big potential developments, including work associated with northern oil and gas, are beginning to buoy up expectations about future capital spending in the province.

British Columbia

British Columbia has managed to continue the strong business momentum achieved in 1971, and has thus remained one of the fastest growing areas in the country. Mainly on the strength of mammoth lumber shipments, the province's forest industry has recorded large gains over the past two years. In addition, with new capacity coming into operation during this period in wood pulp and various minerals, the output from the whole resource sector has been greatly enlarged. Employment growth in the province has continued to reflect this momentum; following a gain of 4.6% for the whole of 1971, employment during the first seven months this year was some 5.8% above the comparable period of last year. However, activity since the late spring has been impeded by a series of major work stoppages and resultant layoffs in other affected industries. With labour force growth in the province continuing to run well above the national average, the seasonally adjusted unemployment rate has edged up again to over 7½% after a notable improvement in the closing months of last year.

Lumber shipments, which can at times account for up to 30% of British Columbia's export earnings, have continued to boom this year in direct reflection of the record rates of housing starts across North America. The volume of sawmill production in the first half of this year showed an 11% gain from a year ago, on the heels of a 15% increase during the whole of 1971. Gains for this year in total may be somewhat smaller, however, as industrial disputes have cut into production since June. In addition, demand may begin to slacken somewhat towards year-end in line with the expected slowing of North American housing activity. While international pulp prices are unlikely to show any significant improvement this year, early signs of firming in the European and Japanese markets promise a more remunerative year for pulp producers in 1973. Thus the completion of new mills at Quesnel and Mackenzie and of a massive capacity expansion near Kamloops during the second half of this year should be putting the industry into a good sales position for the period ahead.

Output from the mineral sector—copper and coal in particular—is continuing at a high rate. Between 1965 and 1971 the value of B.C. mineral and fuel production rose by nearly 90%, and despite still-low copper prices, a further value gain appears in the making this year. The Japanese market, which last year absorbed 92% of B.C. copper, has shown much less strength in 1972, with the cancellation of orders giving rise to some concern. On the other hand, the extensive coal mining operations near Fernie, also built up on long-term Japanese contracts, have begun to boost output significantly this year.

With several projects reaching completion and few new ones contemplated in the near term, business capital outlays this year are quite subdued. Major ongoing projects include a continuation of the hydro-electric projects on the Peace and Columbia Rivers, the expansion of a natural gas-treating plant at Fort Nelson, and the enlargement of port facilities at Vancouver and Squamish.

Harvest worst in 40 years in Peace area

By GORDON AALBORG
Journal Peace Area Bureau

BEAR CANYON — This year has been the worst for crops that farmers here have seen in 40 years.

Farmers on the western edge of the Alberta Peace country and in much of the B.C. Peace River Block will be facing several hardships this winter and into next year because drought, hail, winds and a series of wet, heavy snowfalls combined to leave them with no harvest worth discussing.

Ernie Parliament got 1½ truckloads of wheat off a 160-acre field. It's just one example of many. Some farmers got none of their crop off.

"This would have been a No. 3 wheat at 25 or 30 bushels to the acre," says Mr. Parliament, considered one of the better managers in this region.

"If we got four bushels, I'd be surprised."

What's worse, he suggests, is there's no apparent possibility of getting the remainder of the crop next spring. The ground is wet and the grain is sprouting in the swaths or buried in the mud.

Standing crops were flattened and hammered into the ground by two successive heavy snowfalls.

Farmers throughout the region have been left with virtually no cash crop, no likelihood of salvaging a significant amount of currently unharvested grain, no seed grain for spring, a shortage of feed and even a shortage of bedding straw for their livestock.

But far worse is the prospect for next year, according to members of the Bear Canyon local of Unifarm.

They were virtually unanimous during a recent meeting in saying the lack of normal autumn farm work will wreak havoc with their 1973 operations.

Almost no summer fallowing was done this year. No land was prepared for next spring's planting. And before anything else can be done next spring, unharvested crops must be disposed of in some fashion.

Proposed cash advances on unharvested grain in the swath have been criticized by some district farmers.

"I wouldn't take an advance on it," says H. I. Patterson, who got two loads of wheat off 430 acres and "it was so wet it wouldn't run out of the box."

"An advance would just put you that much deeper in debt," he says, adding that a further attempt at harvest likely wouldn't gain enough to pay for the fuel.

Albert Campbell has turned his cattle into the wheat fields and is praying for a continuation of moderate weather with little snow.

"Every month we can run them out there it's 1,500 bales I've saved for later," he says.

Fred Herzog, manager of the Peace River Stockgrowers' Association, says he'll have to buy 5,000 bales of hay or sell some stock to feed the rest.

"I even had trouble getting chicken feed," he says.

"Provision of feed for livestock is going to be a problem for most area ranchers and everybody's going to have trouble getting seed grain for spring."

Many of this district's farmers have headed to the bush seeking winter work just to keep food on the table and debtors at least partially satisfied until next year.

"If there weren't a few jobs around, there'd be a lot of people hungry," said one Unifarm spokesman.

The major immediate step suggested to relieve the staggering economy here is some form of moratorium on major farm debts such as land and machinery.

A year's grace that means a doubling of payments next year would only add to the burden, say most farmers. They advocate an interest-free program to put this year's payments onto the end of their loans.

An outright subsistence grant, rather than a further loan fund, would be of some assistance. Several farm organizations suggested a program involving a $10 per acre payment to a maximum of 250 acres, with an additional $5 per acre grant on all acreage above that amount.

Government aid in providing fodder and seed grains is vital to both grain farmers and stockmen and it has been suggested the province act as a purchasing agent for such a program.

On a more long-range basis, vast improvements to the crop insurance program are being suggested. One of the most basic is a system whereby each quarter-section is individually insured, rather than being balanced against the remainder of a farmers' holdings in the event of a loss.

EDMONTON JOURNAL

DECEMBER 1, 1972.

APPENDIX I - TABLE I-7

CITY OF EDMONTON PLANNING TRACTS (GROWTH) UNIVERSITY SOCIAL INDEX CALCULATIONS

Tracts 13, 14, 18, 19, 23, 24 .14296 -.09456 .04840 ÷ 6 = .00807 .00807 X 11 .08877 + .14296 .23173	**Tract 4** .07132 -.05318 .01814 ÷ 6 = .00302 X 11 yrs. .03322 .07132 + .03322 .10454	**Tract 15 & 39 & 20** .04962 -.03598 .01364 ÷ 6 = .00227 X 11 .02497 + .04962 .07459 .07459 + .04569 (Tract 20) .12028 ÷ 2 = .06014
Tracts 33 & 45 .24360 -.17647 .06713 ÷ 6 = .01119 X 11 .12309 .12309 + .06271 .36669	**Tracts 43 & 47** .11901 -.09853 .02048 ÷ 6 = .00341 X 11 .03751 .03757 + .11901 .15652	**Tracts 49,50 ,2,52,53,54** .06000 -.04492 .01508 ÷ 6 =.00251 X 11 .02761 .02761 + .06000 .08761
Tracts 56 - 59 .06272 -.03406 .02866 ÷ 6 = .00478 X 11 .05258 .05258 + .06272 .11530	**Tracts 60 & 61** .10535 -.07227 .03308 ÷ 6 = .00551 X 11 .06061 .06061 + .10535 .16596	**Tracts 62 & 63** .14667 -.09293 .05374 ÷ 6 =.00896 X 11 .09856 .09856 + .14667 .24523
Sherwood Park .05368 -.05195 .00173 ÷ 4 = .00043 X 11 .00473 .00473 + .05368 .05841 N/A St. Albert 1971 used.	**Tract 51** .03936 -.01488 .02448 ÷ 4 = .00612 X 11 .06732 .06732 + .03936 .10668 Growing & New Area	**Tracts 1, 35, 55** .07121 -.04742 .02379 ÷ 6 =.00397 X 11 .04367 .04367 + .07121 .11488
Tracts 21 & 40 .24980 -.19525 .05455 ÷ 6 = .00909 X 11 .09999 .09999 + .24980 .34979	**Tracts 31, 32, 34, 44** .10869 -.07680 .03189 ÷ 6 = .00531 X 11 .05841 .05841 + .10869 .16710	**Tracts 25, 26, 27, 48** .12636 -.09672 .02964 ÷ 6 =.00496 X 11 .05456 .05456 + .12636 .18092
Tracts 41 & 42 .14676 -.11990 .02686 ÷ 6 = .00471 X 11 .05181 .05181 + .14676 .19857	**Tracts 5, 6, 7** .05785 -.03957 .01828 ÷ 6 = .00328 X 11 .03355 .03355 + .05785 .09140	**Tracts 3, 8, 36, 37** .09596 -.08850 .00746 ÷ 6 =.00124 X 11 .01364 .01364 + .09596 .10960
Tracts 29 & 30 .2272 -.2153 .0119 ÷ 6 = .00200 X 11 .0220 .0220 + .22720 .24920	**Tracts 5, 6, 7, 9 & 10 & 11** .09140 81/82 +.07178 70/71 Stable +.04891 70/71 Stable .21209 ÷ 3 = .07030 81/82	**Tracts 12 & 16** .11807 -.10186 .01621 ÷ 6 = .00276 X 11 .02970 .02970 + .11807 .14777
St. Albert .10828 -.06360 .04468 ÷ 6 = .00745 X 11 .08195 .08195 + .10828 .19023		

APPENDIX I

TABLE I-8

STUDENT AND STAFF POPULATION
1967 TO PRESENT
ALBERTA COLLEGES SYSTEM***

COLLEGE	FTE			Academic Staff	Admin. Staff	Support Staff
Grande Prairie	67-68	122		20	4	14
	68-69	243		22	6	18
	69-70	227		23	7	20
	70-71	323		26	7	25
	71-72	350*	370**	31	7	30
Grant MacEwan	71-72	600*	575**	16	30	58
Lethbridge	67-68	860		35	11	31
	68-69	734		29	6	24
	69-70	686		43	7	65
	70-71	1,040		88	11	258
	71-72	1,225*	1,200**	67	11	133
Medicine Hat	67-68	170		16	4	7
	68-69	337		19	4	7
	69-70	342		25	6	12
	70-71	477		35	8	14
	71-72	694*	606**	45	11	38
Mount Royal	67-68	1,396		77	10	92
	68-69	1,658		102	10	102
	69-70	1,983		111	14	111
	70-71	2,306		125	15	125
	71-72	2,396*	2,300**	135	15	139
Red Deer	67-68	225		15	3	5
	68-69	347		25	5	15
	69-70	487		47	6	29
	70-71	904		59	7	38
	71-72	1,100*	820**	66	10	58

*Projected 1971-72.
**Probable 1971-72.

*** Source: Alberta Colleges Commission.

APPENDIX I

TABLE I-9

THE UNIVERSITY OF ALBERTA ESTIMATED 1981/1982 FACULTY AND STAFF TRANSPORTATION PLANNING POINT OF VIEW*

1970 Base Year Faculty and Staff

I. December 1970 Staff -- Payroll Records

A. Full Time Staff (By Budget No. Categories, etc.)

ACADEMIC			NON ACADEMIC		
Prof.	30	335	General	10	266
	31	346		11	348
	32	314		12	417
	33	360		13	313
	34	245		14	294
E.P.S.	35	83		15	257
				16	387
				17	262
				18	204
				19	261
				20	97
Total Full Time		1683			3106

B. Part Time and Sessional (Budget Categories, etc.)

Med. Supp		315	Bakeshop	7
Dent. Supp		36	Bookstore	4
Fellowship		173	Housing	47
			H/F Services	9
Student	50	311	Lab Animal Serv	5
	51	328	Laundry	--
OMIT:	52	300	Lister Hall Cafe	139
SHOWN	53	299	Married Stud. Housing	--
FOR INFO	54	252	Physical Plant	181
ONLY.	55	226	Printing	3
	56	216	Security	6
			Shipping & Rec.	14
			S.U.B. Cafe	64
			S.U. Winter Trust	90
			Tuck Shop (R.I.P.)	--
			Vehicle Pool and Garage	7
			Vending	1
Totals -------		2456		577

* Source: The University of Alberta Payroll Statistics.

APPENDIX I

TABLE I-9 - (Cont'd.)

1981/1982 Faculty and Staff Estimate

1. Additional Data

   1970/1971 Full-Time Equivalent Non-Student Staff (Faculties plus Schools only) 1,492.6*

   Comparable Academic Planning Report Number 9 Estimate 2,136.0*

   (Source Reference 49 plus addendums.)

2. The Future Staff Estimate.

ACADEMIC Full Time 1683 Med & Dent Supp $\frac{315 + 36}{2} =$ 176 Fellowship 173 TOTAL 70/71 = 2032	Ratio 70/71 to 70/71 F.T.E. Staff Academic Planning $\frac{1492.6}{2032} = 0.73455$	Plan 9 Average Staff & Transport Plan Figure $\frac{2136.0}{0.73455} = 2908$
NON ACADEMIC Full Time 3106 Part Time 577 TOTAL 70/71 3683	Ratio Plan 9 Academic Staff to 1970/71 $\frac{2032}{2908} = 0.69876$	Plan 9 Average Staff & Transport Plan Figure $\frac{3683}{0.69876} = 5271$
TOTAL TRANSPORTATION PLANNING FACULTY AND STAFF = 8179		

Remarks to add a physical dimension to the above human resources calculation.

1. From 1970/71 to 1981/82 the U. of A. will occupy an additional 1,000,000 net square feet of teaching and research space. (over and above 3,124,000 net square feet of all campus space.)
2. In 1972 U. of A. is adding a 900 suite housing complex (Hub Housing Union Building) including 40 plus commercial establishments.
3. All essential campus services will gradually grow accordingly. (i.e. Maintenance and Operation, Libraries, Food Services, Printing Services, Technical Services, Student Health, etc.)

APPENDIX II

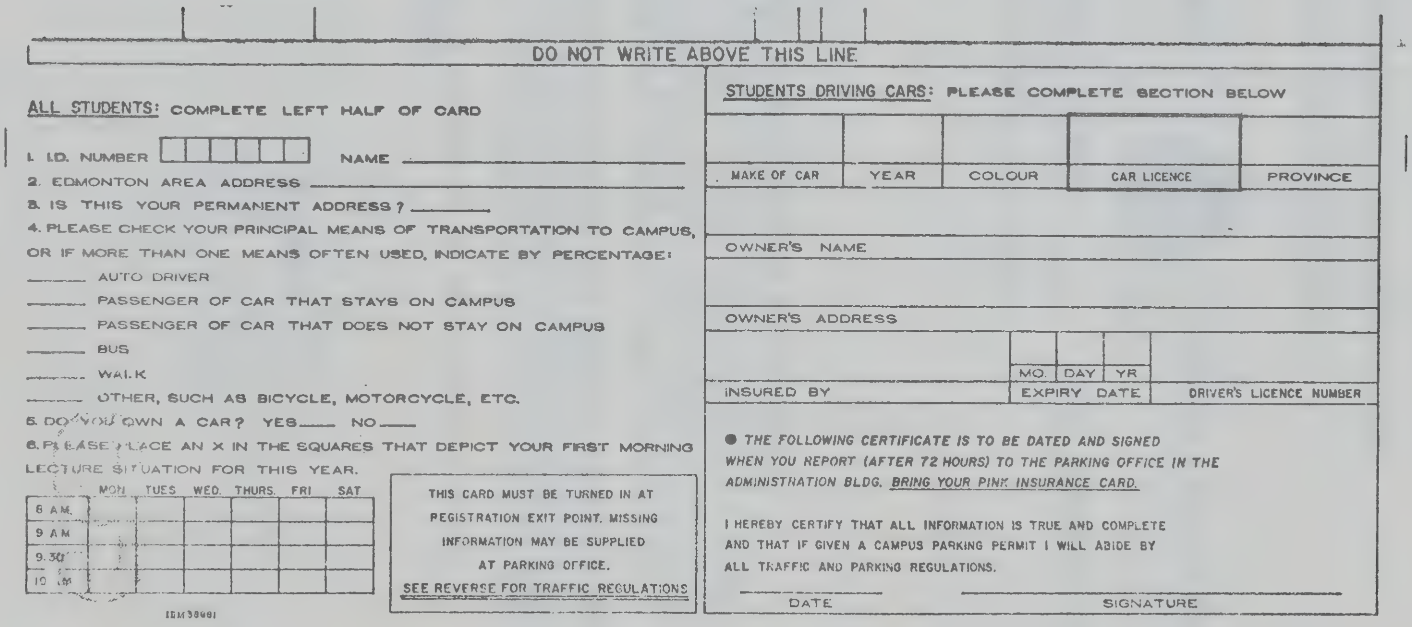
MODE SPLIT ANALYSIS INFORMATION

- Sample Transportation Questionnaires
- Associated Engineering Travel Times 1966
- Travel Time Difference Mode Split Tables
- Sensitivity Analysis
- Staff 100% Employment Mode Splits
- Typical City Mode Split Curve
- Travel Stability Zones
- Historic Bus Service
- Student Complaint Letters to The Parking Office

APPENDIX II

STUDENT TRANSPORTATION QUESTIONNAIRE AND CAMPUS AUTOMOBILE REGISTRATION 1967/1968

The University of Alberta September, 1967,
Student Registration Procedure, Number 9 Card



DO NOT WRITE ABOVE THIS LINE

ALL STUDENTS: COMPLETE LEFT HALF OF CARD

1. I.D. NUMBER ☐☐☐☐☐☐ NAME ____________
2. EDMONTON AREA ADDRESS ____________
3. IS THIS YOUR PERMANENT ADDRESS? ______
4. PLEASE CHECK YOUR PRINCIPAL MEANS OF TRANSPORTATION TO CAMPUS, OR IF MORE THAN ONE MEANS OFTEN USED, INDICATE BY PERCENTAGE:

______ AUTO DRIVER
______ PASSENGER OF CAR THAT STAYS ON CAMPUS
______ PASSENGER OF CAR THAT DOES NOT STAY ON CAMPUS
______ BUS
______ WALK
______ OTHER, SUCH AS BICYCLE, MOTORCYCLE, ETC.

5. DO YOU OWN A CAR? YES____ NO____
6. PLEASE PLACE AN X IN THE SQUARES THAT DEPICT YOUR FIRST MORNING LECTURE SITUATION FOR THIS YEAR.

	MON.	TUES	WED.	THURS.	FRI	SAT
8 A.M.						
9 A.M.						
9.30						
10 A.M.						

IBM 38861

THIS CARD MUST BE TURNED IN AT REGISTRATION EXIT POINT. MISSING INFORMATION MAY BE SUPPLIED AT PARKING OFFICE.
SEE REVERSE FOR TRAFFIC REGULATIONS

STUDENTS DRIVING CARS: PLEASE COMPLETE SECTION BELOW

MAKE OF CAR	YEAR	COLOUR	CAR LICENCE	PROVINCE

OWNER'S NAME

OWNER'S ADDRESS

	MO.	DAY	YR	
INSURED BY	EXPIRY DATE			DRIVER'S LICENCE NUMBER

● *THE FOLLOWING CERTIFICATE IS TO BE DATED AND SIGNED WHEN YOU REPORT (AFTER 72 HOURS) TO THE PARKING OFFICE IN THE ADMINISTRATION BLDG.* ***BRING YOUR PINK INSURANCE CARD.***

I HEREBY CERTIFY THAT ALL INFORMATION IS TRUE AND COMPLETE AND THAT IF GIVEN A CAMPUS PARKING PERMIT I WILL ABIDE BY ALL TRAFFIC AND PARKING REGULATIONS.

DATE ____________ SIGNATURE ____________

APPENDIX II

STAFF TRANSPORTATION QUESTIONNAIRE AND COVERING LETTER 1966/1967 (2)

INTER-DEPARTMENTAL CORRESPONDENCE

TO All Staff, University of Alberta **DATE** October, 1966.

FROM Campus Development Office

Dear Staff Member,

Staff Transportation Questionnaire

As part of a continuing programme of campus transportation research, we are forwarding to you this year's questionnaire with the sincere hope that you will complete it immediately and return it to this office.

Our objective with this year's questionnaire is to get as close as possible to a 100% return which, when compared with last year's survey, will enable more knowledgeable projections and transportation planning to be made.

Your co-operation is most important and earnestly solicited.

Yours truly,

J.R.B. Jones, Director,
Campus Development

Enc.

APPENDIX II

Please return to: Campus Development Office
Box 874, Administration Building
(or Room 111, Administration Building)

November, 1966

TRANSPORTATION QUESTIONNAIRE - STAFF

1. Name .... Address ....

2. Please indicate with an X in the appropriate square the nature of your employment with the University of Alberta

	Full-time staff	Part-time staff
Academic (Faculty & Administrators, Post Docs. & Grads. etc.)		
Non-academic		

3. Are you presently enrolled in the Faculty of Graduate Studies at the University of Alberta? Yes .... No ....

(Note: Graduate students only need not complete questions 4 & 5, having already completed the No. 9 card at the time of registration. Please mail questionnaire to the Campus Development Office as is.)

4. Please check your principal means of transportation to the University, or if more than one means often used, indicate by percentage.

.... Automobile owner/operator

.... Passenger of a car that stays at campus (car pool member)

.... Passenger of a car that does not stay at campus

.... Bus

.... Walk

.... Other

5. For the purpose of calculating the staff portion of peak hour traffic entering the campus, please indicate with an X per day your approximate daily arrival time at campus.

a.m.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
7:30						
7:45						
8:00						
8:15						
8:30						
8:45						
9:00						
9:15						
9:30						
9:45						
10:00						

Thank you for your cooperation
Please return to the Campus Development Office

APPENDIX II

STUDENT TRANSPORTATION QUESTIONNAIRE 1970/1971 (34)

TRANSPORTATION CARD (1970-1971 ACADEMIC TERM)

2 ☐ 5

1. Edmonton Area Address: ....

2. 8 ☐ 13 Identification No.　　14 ☐ Surname

3. Is the above address your parent's/guardian's address?　(1) Yes 18 ☐　(2) No ☐

4. Please check your principal means of transportation to campus, or if more than one means often used, indicate by percentage.

19	1. ☐	Auto Driver
20	2. ☐	Bus
21	3. ☐	Walk
22	4. ☐	Passenger of car that stays on campus
23	5. ☐	Passenger of car that does not stay on campus
24	6. ☐	Other, such as bicycle, motorcycle, etc.

5. Do you own a car?　25 1. ☐ Yes　26 Year ....　28 Estimated Value ....
　2. ☐ No　Make/Model

6. In the appropriate blanks, please print the hour of day you would likely arrive and leave campus: (please use the 24 hour clock to nearest ¼ hour. e.g.: 1:30 p.m. = 1330 hours)

33　50

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Arrive on campus						
Leave campus						

51　68

7. How often will you return to campus in the evenings? (please check)
69
- ☐ 1. Less than once a month
- ☐ 2. Less than once a week
- ☐ 3. About once a week
- ☐ 4. Twice a week
- ☐ 5. Three times a week
- ☐ 6. More than three times a week

8. **Please answer both A and B regarding travel time to University each week day.**
(A) If you were to travel from your residence to campus by car, what would the travel time be?　70 ☐ Hrs. ☐ Mins.
(B) If you were to travel from your residence to campus by bus, what would your travel time be?　74 ☐ Hrs. ☐ Mins.

9. (a) Do you (or will you) have a job in addition to attending university?　18 1. ☐ Yes　2. ☐ No　3. ☐ Don't know yet

10. (a) If the answer to question 9 is "Yes" how many hours per week are you likely to work on your job?　19 ☐ Hrs.

(b) Is your job located on or off campus?　23 1. ☐ On campus　2. ☐ Off campus

(c) If your job is located off-campus, please check the geographical area where you work.
24
1. ☐ Central Business District (downtown)　2. ☐ South side of river
3. ☐ North side of river (except downtown)　4. ☐ Outside of Metro Edmonton

11. (a) Do you have children?　25 0. ☐ No child　1. ☐ 1 child　2. ☐ 2 children
Please check one:　3. ☐ 3 children　4. ☐ more than 3 children

(b) If you have pre-school children please indicate who takes care of them.
26
1. ☐ A paid babysitter　3. ☐ A play school/nursing school　5. ☐ Wife/husband
2. ☐ A day care centre　4. ☐ A friend/relative　6. ☐ Other

APPENDIX II

STAFF TRANSPORTATION QUESTIONNAIRE AND COVERING LETTER 1970/1971 (34)

INTER-DEPARTMENTAL CORRESPONDENCE

TO

DATE October 30th, 1970

FROM The Office of Institutional
Research and Planning
111 University Hall

Dear Staff Member:

RE: Transportation Information
1970/71

The Office of Institutional Research and Planning has, for a number of years, been involved with transportation studies relating to both students and staff. Student questionnaires, completed during registration week, are presently being processed.

However, we also require data on the transportation patterns of staff and we are asking you, therefore, to complete the enclosed questionnaire. Please return it to our office by November 11th, 1970.

Thank you,

W. J. Williamson

W. J. Williamson, Research Officer,
Institutional Research
and Planning

Enclosure (1)

APPENDIX II

FACULTY AND STAFF TRANSPORTATION FORM 1970-71

1. Please note Machine applied staff name goes here.

2. ☐

Edmonton Area Address: ....

3. Please indicate with a check in the appropriate square the nature of your employment with the University of Alberta

	Full-time Staff	Part-time Staff
Academic Staff	☐	☐
Non-Academic Staff	☐	☐

4. Please check your principal means of transportation to campus, or if more than one means often used, indicate by percentage.

1. ☐	Auto Driver	4. ☐	Passenger of car that stays on campus—(car pool)
2. ☐	Bus	5. ☐	Passenger of car that does not stay on campus
3. ☐	Walk	6. ☐	Other, such as bicycle, motorcycle, etc

5. Do you own a car? 1. ☐ Yes 2. ☐ No

6. How often will you return to campus in the evenings? (please check)
   - ☐ 1. Less than once a month
   - ☐ 2. Less than once a week
   - ☐ 3. About once a week
   - ☐ 4. Twice a week
   - ☐ 5. Three times a week
   - ☐ 6. More than three times a week

7. Please answer both A and B regarding travel time to University each week day.

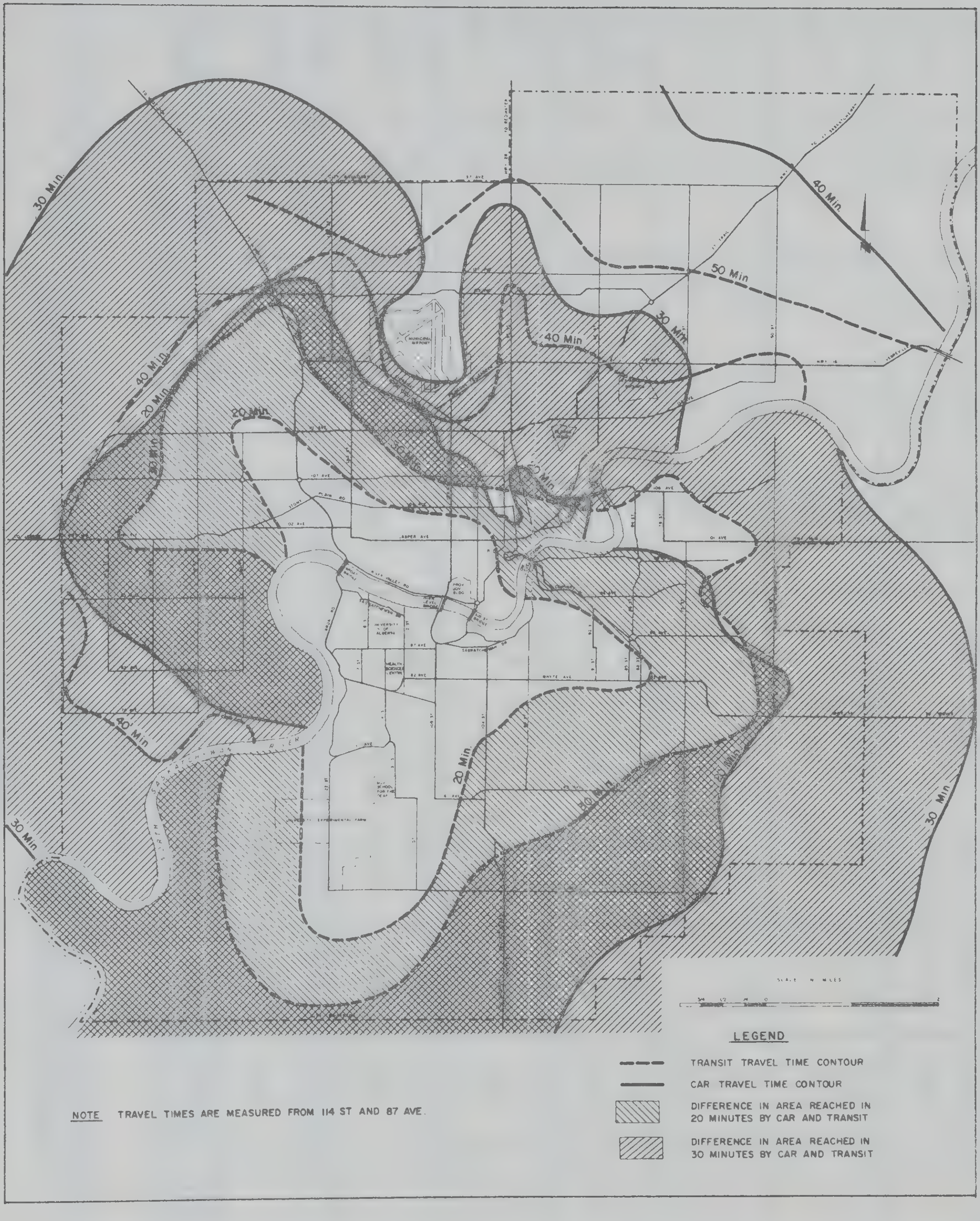
   (A) If you were to travel from your residence to campus by car, what would the travel time be? ☐ Hrs. ☐ Mins.

   (B) If you were to travel from your residence to campus by bus, what would your travel time be? ☐ Hrs. ☐ Mins.

8. In the appropriate blanks, please print the hour of day you would likely arrive and leave campus: (please use the 24 hour clock to nearest ¼ hour. e.g.: 1:30 p.m. = 1330 hours)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Arrive on campus						
Leave campus						

Footnote: Rectangular box (top right) is for METS Zone coding done upon receipt of completed questionnaire.



NOTE TRAVEL TIMES ARE MEASURED FROM 114 ST AND 87 AVE.

APPENDIX II

FIGURE 2.1. ASSOCIATED ENGINEERING 1966 TRAVEL TIME BY CAR AND TRANSIT (1, 2)

APPENDIX II

TABLE II-1

STUDENT BUS MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1970/1971

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		<10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	>45	No Measure	TOTAL
Auto Driver	No		169	524	372	642	729	562	436	424	247	4,877
	%		26.8	39.9	32.0	36.2	39.8	44.8	44.2	50.5	65.9	26.7
Car Pool	No		41	114	82	135	172	107	90	124	41	1,075
	%		6.5	8.7	7.1	7.6	9.4	8.5	9.1	14.8	10.9	5.9
Drop-Off	No		32	79	48	96	118	94	68	78	38	808
	%		5.1	6.0	4.1	5.4	6.5	7.5	6.9	9.3	10.1	4.4
Bus	No		365	565	606	842	761	467	373	207	36	5,650
	%		57.9	43.0	52.2	47.5	41.6	37.2	37.8	24.7	9.6	30.9
Walk	No		15	9	35	27	25	12	8	2	10	5,556
	%		2.4	0.7	3.0	1.6	1.4	1.0	0.8	0.2	2.7	30.4
Other	No		8	23	19	30	24	12	12	4	3	315
	%		1.3	1.7	1.6	1.7	1.3	1.0	1.2	0.5	0.8	1.7
TOTAL	No		630	1314	1162	1772	1829	1254	987	839	375	18,281
	%		100	100	100	100	100	100	100	100	100	100

APPENDIX II

TABLE II-2

STUDENT WALK MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1970/1971

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		< 10	10-15	15-20	20-25	25-30	30-35	> 35				TOTAL
Auto Driver	No	229	87	66	411	85	106	3893				4,877
	%	4.5	12.5	15.8	21.7	28.1	30.1	40.6				26.7
Car Pool	No	54	13	14	95	17	20	862				1,075
	%	1.1	1.9	3.4	5.0	5.6	5.7	9.0				5.9
Drop-Off	No	55	12	14	74	20	11	622				808
	%	1.1	1.7	3.4	3.9	6.6	3.1	6.5				4.4
Bus	No	228	153	270	677	167	183	3972				5,650
	%	4.5	21.9	64.9	35.7	55.1	52.0	41.5				30.9
Walk	No	4404	402	47	564	10	21	108				5,556
	%	87.4	57.7	11.3	29.8	3.3	6.0	1.1				30.4
Other	No	71	30	5	73	4	11	121				315
	%	1.4	4.3	1.2	3.9	1.3	3.1	1.3				1.7
TOTAL	No	5041	697	416	1894	303	352	9578				18,281
	%	100	100	100	100	100	100	100				100

APPENDIX II

TABLE II-3

STAFF BUS MINUS CAR TRAVEL TIME DIFFERENCE 100 PER CENT EMPLOYMENT MODE SPLIT 1970/1971

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		⟨10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	⟩ 45		TOTAL
Auto Driver	No		230	366	279	449	444	239	192	198		3046
	%		62.2	60.5	63.5	56.8	64.6	68.5	65.1	80.5		52.5
Car Pool	No		21	73	29	90	77	35	33	16		457
	%		5.7	12.1	6.6	11.4	11.2	10.0	11.2	6.5		7.9
Drop-Off	No		26	48	36	45	34	15	22	17		373
	%		7.0	7.9	8.2	5.7	5.0	4.3	7.5	6.9		6.5
Bus	No		81	108	82	196	128	59	46	15		999
	%		21.9	17.9	18.7	24.8	18.6	16.9	15.6	6.1		17.2
Walk	No		7	5	10	6	3	0	2	0		835
	%		1.9	0.8	2.3	0.7	0.4	0	0.6	0		14.4
Other	No		5	5	3	5	1	1	0	0		87
	%		1.3	0.8	0.7	0.6	0.2	0.3	0	0		1.5
TOTAL	No		370	605	439	791	687	349	295	246		5797
	%		100	100	100	100	100	100	100	100		100

APPENDIX II

TABLE II-4

STAFF WALK MINUS CAR TRAVEL TIME DIFFERENCE 100 PER CENT EMPLOYMENT MODE SPLIT 1970/1971

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		<10	10-15	15-20	20-25	25-30	30-35	> 35				TOTAL
Auto Driver	No	184	71	40	348	55	55	2293				3046
	%	20.2	34.8	47.6	45.5	37.9	47.4	64.1				52.6
Car Pool	No	23	7	2	46	18	9	352				457
	%	2.5	3.4	2.4	6.0	12.4	7.8	9.8				7.9
Drop-Off	No	35	11	6	69	11	15	226				373
	%	3.9	5.4	7.1	9.0	7.6	12.9	6.3				6.4
Bus	No	30	38	30	150	59	32	660				999
	%	3.3	18.6	35.7	19.6	40.7	27.6	18.5				17.2
Walk	No	603	66	6	132	2	3	23				835
	%	66.3	32.4	7.1	17.3	1.4	2.6	0.6				14.4
Other	No	34	11	0	19	0	2	21				87
	%	3.7	5.4	0	2.5	0	1.7	0.6				15.0
TOTAL	No	909	204	84	764	145	116	3575				5797
	%	100	100	100	100	100	100	100				100

APPENDIX II

TABLE II-5

STAFF BUS MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1970/1971

MODE SPLIT		TRAVEL TIME DIFFERENCE (Minutes)										
		< 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	> 45	No Measure	TOTAL
Auto Driver	No		141	218	166	267	264	142	114	118	69	1881
	%		65.0	62.8	65.9	59.3	67.0	70.6	67.5	81.8	88.4	54.7
Car Pool	No		12	40	16	49	42	19	18	9	6	256
	%		5.5	11.5	6.3	10.9	10.7	9.5	10.6	6.3	7.7	7.5
Drop-Off	No		14	26	19	24	18	8	12	9	1	201
	%		6.4	7.5	7.5	5.3	4.6	4.0	7.1	6.3	1.3	5.9
Bus	No		44	57	43	103	67	31	24	8	2	527
	%		19.9	16.4	17.1	22.9	17.0	15.4	14.2	5.6	2.6	15.3
Walk	No		4	3	6	4	2	0	1	0	0	515
	%		1.8	0.99	2.4	0.9	0.5	0	0.6	0	0	15.0
Other	No		3	3	2	3	1	1	0	0	0	56
	%		1.4	0.99	0.8	0.7	0.2	0.5	0	0	0	1.6
TOTAL	No		218	347	252	450	394	201	169	144	78	3436
	%		100	100	100	100	100	100	100	100	100	100

APPENDIX II

TABLE II-6

STAFF WALK MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1970/1971

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		<10	10-15	15-20	20-25	25-30	30-35	> 35				TOTAL
Auto Driver	No	113	44	25	215	34	34	1416				1881
	%	20.4	36.1	51.0	47.8	41.5	50.7	67.1				54.7
Car Pool	No	13	4	1	26	10	5	197				256
	%	2.3	3.3	2.0	5.8	12.2	7.5	9.3				7.5
Drop-Off	No	19	6	3	37	6	8	122				201
	%	3.4	4.9	6.1	8.2	7.3	11.9	5.8				5.8
Bus	No	16	20	16	79	31	17	348				527
	%	2.9	16.4	32.7	17.6	37.8	25.4	16.5				15.4
Walk	No	372	41	4	81	1	2	14				515
	%	67.0	33.6	8.2	18.0	1.2	3.0	0.7				15.0
Other	No	22	7	0	12	0	1	14				56
	%	4.0	5.7	0	2.6	0	1.5	0.6				1.6
TOTAL	No	555	122	49	450	82	67	2111				3436
	%	100	100	100	100	100	100	100				100

APPENDIX II

TABLE II-7

STUDENT BUS MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1967/1968

MODE		TRAVEL TIME DIFFERENCE (Minutes)										TOTAL
SPLIT		< 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	> 45	No Measure	
Auto Driver	No		151	298	283	507	515	371	246	252	112	3,544
	%		31.9	37.7	35.5	41.0	42.1	45.0	41.8	46.3	67.9	27.1
Car Pool	No		29	84	68	94	156	86	60	94	17	865
	%		6.1	10.6	8.5	7.6	12.8	10.4	10.2	17.3	10.3	6.6
Drop-Off	No		40	55	52	99	115	69	43	52	19	726
	%		8.4	7.0	6.5	8.0	9.4	8.4	7.3	9.6	11.5	5.5
Bus	No		243	341	377	513	417	284	230	140	10	3,574
	%		51.2	43.2	47.3	41.5	34.1	34.5	39.1	25.7	6.1	27.3
Walk	No		10	7	15	17	16	8	8	6	7	4,311
	%		2.1	0.9	1.9	1.4	1.3	1.0	1.3	1.1	4.2	32.9
Other	No		1	5	2	6	3	6	2	0	0	73
	%		0.2	0.6	0.3	0.5	0.3	0.7	0.3	0	0	0.6
TOTAL	No		474	790	797	1236	1222	824	589	544	165	13,093
	%		100	100	100	100	100	100	100	100	100	100

APPENDIX II

TABLE II-8

STUDENT WALK MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1967/1968

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		< 10	10-15	15-20	20-25	25-30	30-35	> 35				TOTAL
Auto Driver	No	265	123	51	339	47	94	2625				3,544
	%	6.5	18.1	20.9	25.8	30.3	34.6	41.4				27.1
Car Pool	No	54	25	13	84	10	17	662				865
	%	1.3	3.6	5.4	6.4	6.4	6.2	10.5				6.6
Drop-Off	No	59	27	11	84	7	9	529				726
	%	1.4	4.0	4.5	6.4	4.5	3.3	8.3				5.5
Bus	No	170	155	155	444	89	143	2418				3,574
	%	4.2	22.9	63.5	33.9	57.4	52.6	38.1				27.3
Walk	No	3516	338	13	350	1	9	84				4,311
	%	86.0	49.9	5.3	26.7	0.7	3.3	1.3				32.9
Other	No	25	10	1	11	1	0	25				73
	%	0.6	1.5	0.4	0.8	0.7	0	0.4				0.6
TOTAL	No	4089	678	244	1312	155	272	6343				13,093
	%	100	100	100	100	100	100	100				100

APPENDIX II

TABLE II-9

STAFF BUS MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1966/1967

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		<10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	> 45	No Measure	TOTAL
Auto Driver	No		166	102	128	178	175	134	89	79	34	1599
	%		76.1	72.3	67.7	65.4	75.7	70.5	78.1	79.0	82.9	63.7
Car Pool	No		10	12	14	28	12	10	5	10	4	157
	%		4.6	8.5	7.4	10.3	5.2	5.3	4.4	10.0	9.8	6.0
Drop-Off	No		6	3	10	12	7	11	6	4	2	93
	%		2.8	2.1	5.3	4.4	3.1	5.8	5.3	4.0	4.9	3.7
Bus	No		33	24	36	52	37	34	14	7	1	340
	%		15.1	17.0	19.1	19.1	16.0	17.9	12.3	7.0	2.4	13.6
Walk	No		1	0	1	1	0	1	0	0	0	308
	%		0.5	0	0.5	0.4	0	0.5	0	0	0	12.3
Other	No		2	0	0	1	0	0	0	0	0	18
	%		0.9	0	0	0.4	0	0	0	0	0	0.7
TOTAL	No		218	141	189	272	231	190	114	100	41	2509
	%		100	100	100	100	100	100	100	100	100	100

APPENDIX II

TABLE II-10

STAFF WALK MINUS CAR TRAVEL TIME DIFFERENCE MODE SPLIT 1966/1967

MODE		TRAVEL TIME DIFFERENCE (Minutes)										
SPLIT		<10	10-15	15-20	20-25	25-30	30-35	> 35				TOTAL
Auto Driver	No	185	85	22	219	31	34	1023				1599
	%	39.1	61.6	57.9	61.5	67.4	60.7	72.9				63.7
Car Pool	No	15	9	1	24	2	2	98				151
	%	3.2	6.5	2.6	6.7	4.3	3.6	7.0				6.0
Drop-Off	No	10	4	3	14	1	4	57				93
	%	2.1	2.9	7.9	3.9	2.2	7.1	4.1				3.7
Bus	No	17	13	11	55	11	16	217				340
	%	3.6	9.4	29.0	15.5	23.9	28.6	15.5				13.6
Walk	No	240	25	0	38	1	0	4				308
	%	50.7	18.1	0	10.7	2.2	0	0.3				12.3
Other	No	6	2	1	6	0	0	3				18
	%	1.3	1.5	2.6	1.7	0	0	0.2				0.7
TOTAL	No	473	138	38	356	46	56	1402				2509
	%											

APPENDIX II

TABLE II-11

STUDENT AND STAFF TRAVEL TIME DIFFERENCE MODE SPLIT PLOTS SENSITIVITY ANALYSIS -- SUM OF SQUARE ERRORS

Item	Degree of Curve	SUM OF SQUARE ERRORS	
		For Polynomial Curves	For Exponential Curves
		Least Square Error	Least Square Error
1970/71 Students			
Walk -Car	2	25.41	29.16
	3	25.11	30.03
	4	24.71	28.62
Bus -Car	2	11.69	12.30
	3	10.49	10.44
	4	10.20	10.32
1970/71 Staff			
Walk -Car	2	15.06	16.89
	3	13.38	14.09
	4	13.35	14.62
Bus -Car	2	5.99	7.12
	3	5.39	6.89
	4	4.88	6.30
1967/68 Students			
Walk -Car	2	26.09	51.79
	3	25.22	27.47
	4	25.16	28.19
Bus -Car	2	10.18	10.29
	3	9.77	10.01
	4	8.97	9.58
1966/67 Staff			
Walk -Car	2	14.88	High
	3	10.58	High
	4	10.08	High
Bus -Car	2	3.05	3.95
	3	2.90	3.36
	4	2.77	2.75

APPENDIX II

TABLE II-12

STUDENT AND STAFF TRAVEL TIME DIFFERENCE BUS MINUS CAR MODE SPLIT PLOTS SENSITIVITY ANALYSIS -- SUM OF SQUARE ERRORS WITH FIRST OR LESS THAN 10 MINUTE POINT OMITTED

Item	Degree of Polynomial Curve	SUM OF SQUARE ERRORS	
		5 Minute Point Omitted	5 Minute Point Not Omitted
1970/71 Students Walk -Car	2	25.4	25.41
	3	23.16	25.11
	4	18.59	24.71
1970/71 Staff Walk -Car	2	14.02	15.06
	3	13.27	13.38
	4	11.02	13.35
1967/68 Students Walk -Car	2	25.92	26.09
	3	24.16	25.22
	4	18.82	25.16
1966/67 Staff Walk -Car	2	11.34	14.88
	3	10.57	10.58
	4	6.48	10.08

APPENDIX II

TABLE II-13

STUDENT AND STAFF TRAVEL TIME DIFFERENCE WALK MINUS CAR MODE SPLIT PLOTS SENSITIVITY ANALYSIS -- SUM OF THE SQUARE ERRORS WITH 17.5 MINUTE POINT OMITTED

ITEM	DEGREE OF CURVE	SUM OF SQUARE ERROR	COMMENT
1970/71 Students Walk-Car	2	11.40	
	3	10.15	Best Curve.
	4	9.99	Curves up at end No Good.
1970/71 Staff Walk-Car	2	8.18	
	3	7.86	Best Curve.
	4	6.81	Curves up at end No Good.
1967/68 Students Walk-Car	2	11.32	
	3	11.04	Best Curve.
	4	10.02	Curves up at end No Good.
1966/67 Staff Walk-Car	2	9.01	
	3	6.30	Best Curve.
	4	2.62	Curves up at end No Good.

APPENDIX II

TABLE II-14

STAFF QUESTIONNAIRE RETURN SUCCESS RATIOS 1970/1971

	FULL-TIME STAFF	PART-TIME STAFF	TOTAL STAFF
ACADEMIC STAFF			
Number Returned	1,310	111	1,421
Number Mailed Out	1,668	405	2,073
Percentage Return	78.5	27.4	68.6
NON-ACADEMIC STAFF			
Number Returned	2,010	138	2,148
Number Mailed Out	3,075	649	3,724
Percentage Return	65.4	21.3	57.7
TOTAL FACULTY AND STAFF			
Number Returned	3,320	249	3,569
Number Mailed Out	4,743	1,054	5,797
Percentage Return	70.0	23.6	61.6

APPENDIX II

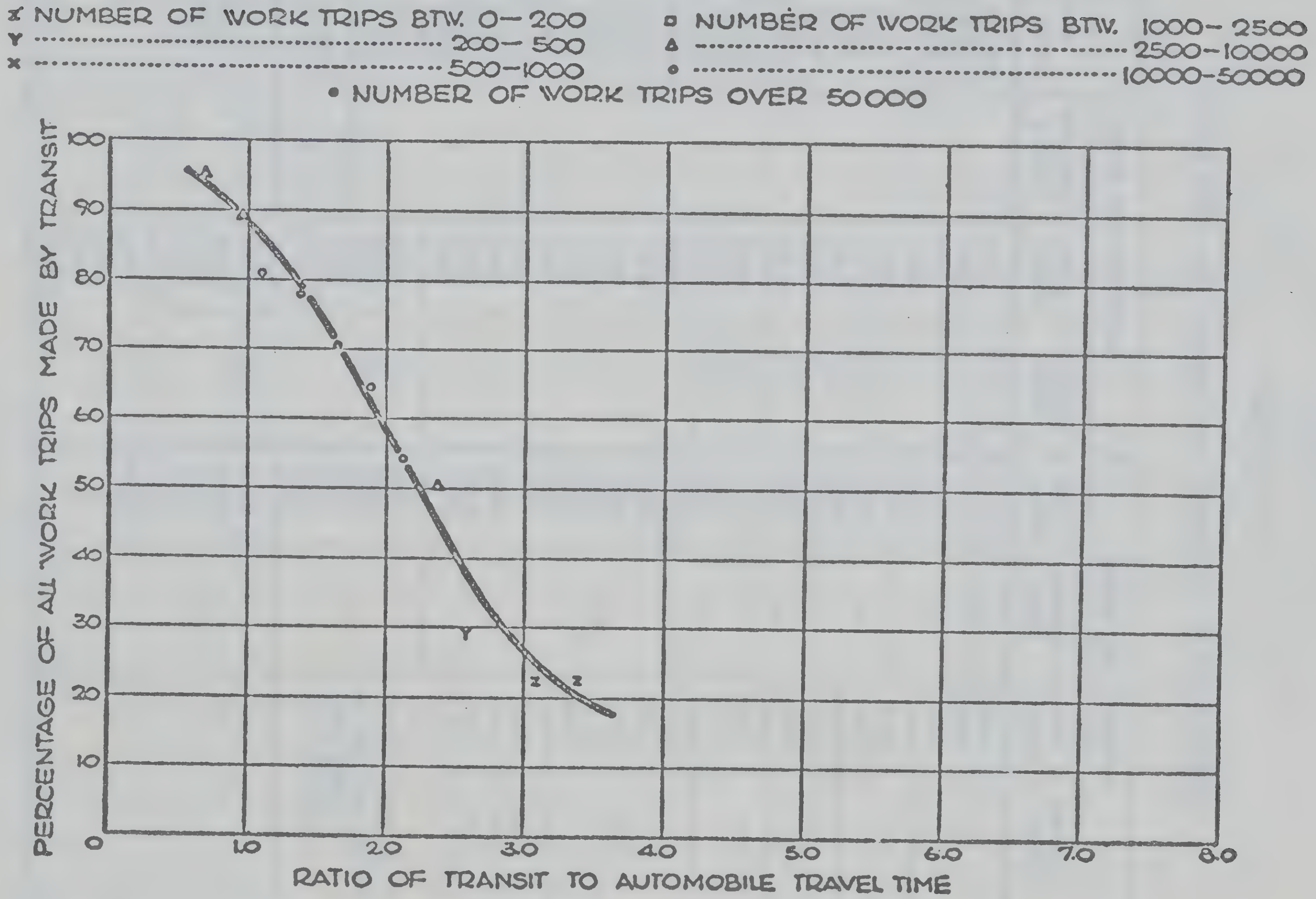
TABLE II-15

FACULTY AND STAFF TRAVEL MODES 1970-1971 EXTENDED PROPORTIONATELY TO 100% EMPLOYMENT

TYPE OF STAFF	TRANSPORTATION MODE						TOTAL
	Auto Driver	Bus	Walk	Car Pool	Drop Off	Other	
FULL-TIME ACADEMIC							
Number	1,105	76	357	45	45	40	1,668
Percentage	66.2	4.6	21.4	2.7	2.7	2.4	100.0
PART-TIME ACADEMIC							
Number	234	55	44	36	29	7	405
Percentage	57.7	13.5	10.8	9.0	7.2	1.8	100.0
TOTAL ACADEMIC STAFF							
Number	1,339	181	401	81	74	47	2,073
Percentage	64.6	6.3	19.3	3.9	3.6	2.3	100.0
FULL-TIME NON-ACADEMIC							
Number	1,528	662	311	320	233	31	3,075
Percentage	49.7	21.2	10.1	10.4	7.6	1.0	100.0
PART-TIME NON-ACADEMIC							
Number	179	216	123	56	66	9	649
Percentage	27.5	33.3	18.9	8.7	10.1	1.5	100.0
TOTAL NON-ACADEMIC STAFF							
Number	1,707	868	434	376	299	40	3,724
Percentage	45.8	23.3	11.7	10.1	8.0	1.1	100.0
TOTAL STAFF							
Number	3,046	999	835	457	373	87	5,797
Percentage	52.5	17.2	14.4	7.9	6.5	1.5	100.0

APPENDIX II

FIGURE 2.2. TRANSIT SHARE OF WORK TRIPS RELATED TO TRAVEL TIME RATIO*



* Source: Ref. 29.

NOTE: Graph based on work done by Traffic Research Corporation, for Metro-Toronto in 1961

APPENDIX II

TABLE II-16

TRAVEL MODE AND TRAVEL TIME STABILITY ANALYSIS ZONES

NORTH SIDE EDMONTON				SOUTH SIDE EDMONTON			
METS ZONES	ANALYSIS ZONES	METS ZONES	ANALYSIS ZONES	METS ZONES	ANALYSIS ZONES	METS ZONES	ANALYSIS ZONES
0050 0060 0070	1	0810 0820	8	2010	16	2360 2370 3010	25
0120 0140 0210 0220 0410	2	0870 0880	9	2211 2212	17	2630 2640	26
0230 0240 0250 0720	3	0910 0920 1110	10	2220 2020	18	2710 2720	27
0310 0320 0330 0340	4	0930 0940	11	2110 2410	19	3021 3030	28
0430 0440 0540 0550 0560 0260	5	0960 1010 1020 1031 1032 1041 1042 1120 1150 1160	12	2230 2310	20	2960 3022 3040 3050 3120	29
0510 0520	6	1310 1320 1330 1340	13	2250 2320 2330 2340 2350	21	4120	30
0730 0830 0860	7	1410 1421 1431 1440 1950	14	2440 2460 2470	22	4250	31
		1520 1540 1620 1630	15	2140 2420 2430 2540 2730	23	NOTE: OTHER 4, 5 & 6000,7,8 SERIES METS ZONES NOT ANALYZED.	
				2130 2510 2520 2530 2610 2620	24		

APPENDIX II

TABLE II-17

HISTORICAL CAMPUS BUS SERVICE*

(NUMBER OF BUSES THROUGH THE UNIVERSITY)

ROUTE	7 - 9 a.m.	9:00 a.m.- 4:00 p.m.	4 - 6 p.m.	6:00 p.m.- 12 Midnight
1961				
S6	14	52	16	36
3	12	42	12	-
23	2	7	2	-
TOTAL	28	101	30	36
1962				
R1	8	15	8	15
R2	8	15	8	15
S6	14	56	16	42
U2	8	28	8	2
U3	8	28	8	0
U4	3	8	2	1
TOTAL	49	150	50	75
1965				
S6	11	27	12	21
U2	14	56	16	17
U6	4	14	4	2
R1	8	28	8	12
R2	8	28	8	12
U4	4	-	1	-
U5	4	7	3	-
TOTAL	53	160	51	64

NOTES OF CLARIFICATION

1961 -- 77 buses per day passed through the University. An additional 118 S6 buses passed the University of Alberta Hospital as follows: west on 82 Avenue, north on 114th Street, east on 83 Avenue, south on 112th Street and east on 82 Avenue. 1962 -- 196 buses per day passed through the University. As above an additional 128 S6 buses passed the University of Alberta Hospital. 1962 witnessed a considerable improvement in bus service to the University. 1963 -- In 1963 bus service to the University of Alberta was further improved by routing the S6 bus northward to include the University along 87th Avenue. 1965 -- 328 buses per day passed through the University. Peak Hour (morning) - 30 buses. 1970-1971 -- 350 buses per day passed through the University. Peak Hour (7:30 - 8:30 a.m.) - 48 buses.

* Source: Edmonton Transit System.

APPENDIX II

TABLE II-17 - (Cont'd.)

HISTORICAL CAMPUS BUS SERVICE*

TRANSIT BUSES TO AND FROM UNIVERSITY-HEALTH SCIENCES AREA

BY ROUTE 7 A. M. - 8 P. M.

Week of November 23-27, 1970.

ROUTE	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY	
	INBOUND	OUTBOUND	INBOUND	OUTBOUND	INBOUND	OUTBOUND	INBOUND	OUTBOUND	INBOUND	OUTBOUND
U2 DOWNTOWN	56	51	51	44	54	49	55	50	59	52
U2 LENDRUM	48	52	48	50	52	54	52	55	51	51
R1-R2 DOWNTOWN	56	57	58	50	54	52	58	58	56	55
R1-R2 WHYTE	53	54	55	58	54	54	55	58	54	55
S6	66	65	65	68	67	68	61	68	58	62
U6	27	26	27	27	26	29	26	27	27	28
U5	16	14	14	14	19	19	15	16	14	17

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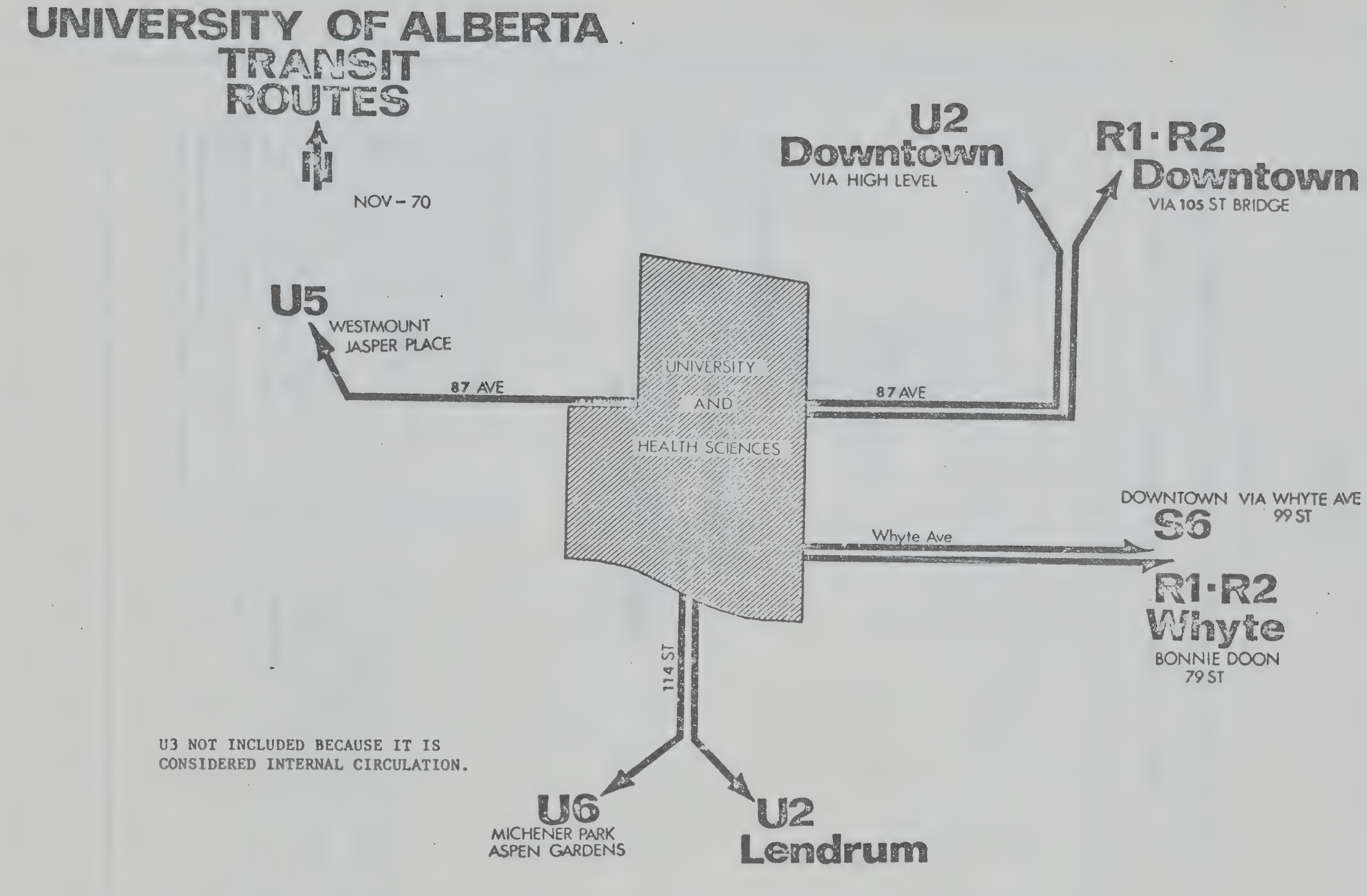
* Source: Ref. 10.

FIGURE 2.3



U3 NOT INCLUDED BECAUSE IT IS
CONSIDERED INTERNAL CIRCULATION.

APPENDIX II

TABLE II-18

SUMMARY OF STUDENT PARKING COMPLAINT LETTERS TO PARKING OFFICE

(Summary Period: September 15 - October 9, 1970)

1. Total Letters: 63

2. Students' Faculty

Dentistry	6
Medicine	3
Law	11
Graduates	6
Faculty Members	2
Undergraduate Students	8
Unknown	27

3. City Geographic Area:

West end	Campus	Rural	Southwest	South
16*	1	1	5	3

Southeast	Northwest	North	Northeast	Unknown
4	4	10*	1	18

4. Common Complaints:

Buses are bad	28*
I have a difficult program	23
Give me specific lot	20
Need car for job	15
I have family responsibilities	14
Must drive wife to work	10
Medical reasons	9
I had permit before	9
Present lot inconvenient	8
Happy with any lot I can get	8
Other are depending on me	8
Must drive kid to babysitter	4
Need car for pool	4
Other have stickers -- why not me?	4
Changed my address	3
Somebody over there made a mistake	2

*Please NOTE the west end and north side bus transit problem (directness of transit routing) of 1970/71 is alluded to by student response.

APPENDIX III

MODE SPLIT

ESTIMATION INFORMATION

- Travel Time
- Invisible Student Growth
- The Campus Environment

APPENDIX III

TABLE III-1

U OF A AND KATES, PEAT, MARWICK TRANSIT TRAVEL TIME COMPARISON*

U OF A PORTAL TO PORTAL TRANSIT TRAVEL TIME-DISTANCE MEASUREMENTS		KATES, PEAT, MARWICK TRANSIT TRAVEL TIME-DISTANCE MEASUREMENTS	
MEASUREMENTS	METS ZONE TO U of A	MEASUREMENTS	STATION TO STATION
1. 15 3/4 inches 77.5 minutes	1920	7 3/4 inches 29.3 minutes	2-82
2. 12 inches 72.5 minutes	1310	8 1/2 inches 38.3 minutes	4-82
3. 8 1/2 inches 64.7 minutes	1120	17 inches 44.3 minutes	60-83
4. 15 1/2 inches 68.2 minutes	1620	8 1/2 inches 46.3 minutes	9-78
5. 14 inches 64.7 minutes	1540	14 1/2 inches 49.3 minutes	60-78
6. 13 3/4 inches 69.2 minutes	4133	9 1/2 inches 40.3 minutes	4-71
7.		4 3/4 inches 45.8 minutes	21-43
8.		12 inches 55.3 minutes	2-64
TOTAL 79.5 inches 416.80 minutes		TOTAL 82.5 inches 348.9 minutes	

As all U of A travel times crossed the Saskatchewan River to U of A in peak travel time, but the Kates, Peat, Marwick times do not, subtract from each time a five minute bridge penalty.

Thus 79.5 inches 416.8 - 6 x 5.0
79.5 inches 386.8

And 1.0 inch 4.87 Minutes.

See thesis section 4.2.1 for description of this travel time comparison calculation.

These times are well distributed North side Edmonton travel times only.

Add walk time house or apartment door to beginning of Peat, Marwick, link time = est. 2.0 minutes average.

Add walk time 87 avenue bus stops to U of A centroid estimated to be 5 minutes average.

Therefore to make portal to portal times; Add
8 x (2 + 5) + 348.9 = 404.9 minutes
And 82.5 inches 404.9 minutes
Or 1 inch 4.91 Minutes

* Source: Ref. 33.

APPENDIX III

TABLE III-2

EXCERPT FROM RAPID TRANSIT FEASIBILITY STUDY UNIVERSITY LINE, DE LEUW, CATHER, CONSULTING ENGINEERS JANUARY, 1971*

PEAK PERIOD TRAVEL TIMES IN MINUTES - 1976				
Station	to Station	By Car	By Bus	By Rapid Transit
NORTHEAST - C.B.D.				
137th Ave.	101 St.	21	31	11
Exhibition	101 St.	13	18	7
Stadium	101 St.	8	13	6
97th St.	101 St.	4	5	4
SOUTHWEST - C.B.D.				
51st Ave.	101 St.	20	30	13
72nd Ave.	101 St.	15	25	10
Health-Sciences	101 St.	12	14	8
University	101 St.	10	13	7
Government	101 St.	6	8	5
NORTHWEST - C.B.D.				
Airport	101 St.	14	15	12
107th Ave.	101 St.	9	16	10
NORTHEAST - UNIVERSITY				
137th Ave.	University	31	52	16
Exhibition	University	23	39	12
Stadium	University	18	34	10
97th St.	University	14	26	8
SOUTHWEST - UNIVERSITY				
51st Ave.	University	9	22	7
72nd Ave.	University	5	6	4
NORTHWEST - UNIVERSITY				
Airport	University	20	36	18
107th Ave.	University	15	37	16

* Source: Ref. 13.

APPENDIX III

TABLE III-3

SAMPLE TRANSIT PORTAL TIME FACTOR CALCULATION 1970/1971 (MINUTES) EDMONTON

METS ZONE	1970/71 ETS BUS SCHEDULE TIME	UNIVERSITY PORTAL TO PORTAL TRAVEL TIME	DIFFERENCE --TRANSIT PORTAL TIME FACTOR	REMARK
1310	50	72.5	22.5	
1320	51	67.4	16.4	Above average bus service.
1330	49	71	23.0	
1340	47	70.3	23.3	
0810	42	64.2	22.2	
0710				
0250	33	61.6	28.6	Below average bus service.
1620	46.0	68.2	22.2	
1930	54.0	79.3	25.3	For furthest areas from U of A time difference increases
1940				
1440	48.0	70.1	22.1	
1421	52.0	72.5	20.5	
1431	54.0	74.3	20.3	
0930	46.0	67.0	21.0	
0940				
AVERAGE TRANSIT PORTAL TIME FACTOR = 22.3 MINUTES				

APPENDIX III

EDMONTON JOURNAL, TUESDAY, JANUARY 30, 1973

'Invisible' students increase at U of A

Probably few persons realize that the University of Alberta has at least 13,000 "invisible" students.

The public commonly thinks about the 17,700 full-time students who, for the most part, attend regular daytime classes.

The invisible students are part-time learners in a variety of courses, seminars and conferences offered by various faculties and departments, says Duncan Campbell, director of the university's department of extension.

By far, the largest group among the 13,000 is enrolled in more than 400 courses offered by the university's department of extension.

Established in 1912, the department recognizes that adults have a continuing need for "relevant information, skills and perspectives" which are readily available in a university setting.

Informal

"It frequently happens that much of education today is informal," Mr. Campbell says. "Increasingly, men and women are interesting themselves in learning for its own sake — not for a degree or a diploma."

There is a drift away from "credentialism" and a tendency towards "voluntary learning." This group of students is becoming more and more significant and formal education agencies across Canada are starting to take note, he says.

In addition to courses, Albertans can obtain books, publications, films, tapes and records from the extension library and educational media division.

Henry Marshall Tory, the first president of the university, observed in his convocation address of 1908 that: "The modern state university has sprung from a demand on the part of the people themselves for intellectual recognition, which only a century ago was denied them."

Cross-Section

Ann Prideaux, extension department administrative assistant, points out that enrolment in extension courses has grown from 8,263 in 1962 to 13,053 in 1972 — an increase of nearly 60 per cent.

"As the number of students grows, and the importance of continuing education is recognized, students who are now 'invisible' will become integrated into the total educational system of Alberta," she says.

Extension students come from a wide cross-section of society. They include, for example, persons interested in vocational fields, persons from both urban and rural centres, and women interested in enhancing their knowledge.

Interviews with a few students who have walked through extension's doors illustrate a high regard for the department's courses.

Beneficial

Paul Babey, former president of the Unifarm organization in Alberta and now chairman of the National Farm Products Marketing Council, says he makes repeated use of the skills he learned years ago when he was enroled in a rural leadership techniques course.

"I took that course of necessity as I had been thrust into a position without any skills. It was most beneficial at that time because I had a job to do without any prior training," Mr. Babey says.

Mrs. Edith Hughes, director of food services at the Misericordia Hospital, first took courses in public speaking but later studied human relations and management to improve her professional skills.

Edmonton lawyer Mrs. Margaret Y. Moxam says she is a strong believer in extension courses on recent legislation. "It is especially important for lawyers to be up to date," Mrs. Moxam says.

Last year, more than 160 lawyers participated in continuing legal education offered by the department.

Updating

Ron Whitby, personnel and labor relations officer for the Edmonton separate school board, completed a certificate program in personnel administration.

Mr. Whitby wants to continue in more personnel administration studies and says he doesn't care whether the approach is towards a degree or through an "updating or refresher approach."

A professional engineer, Ev Carefoot of Associated Engineering Services, enroled in the management development certificate program, also attended the department's Arctic summer school, and took a course in prospecting.

Northern project manager for Associated, Mr. Carefoot says he has worked in the north for some time but feels that he gained a great deal from the Arctic Summer School

Robert Parent, an associate professor of civil engineering at Royal Military College in Kingston, Ont., travels long distances to attend courses here because he maintains the course level is high and cannot be duplicated in other parts of the country.

Housewife Mrs. Jean Cuthbertson has been taking extension art courses for about 10 years. "I like the courses and will probably keep taking them as long as I can get there," she says.

APPENDIX III

STATEMENT OF POLICY ON CAMPUS PLANNING AND DEVELOPMENT*

THE UNIVERSITY OF ALBERTA BELIEVES THAT THE PHYSICAL ENVIRONMENT MATTERS, AND THAT IT MAKES A BASIC CONTRIBUTION TO THE QUALITY OF CAMPUS LIFE. THEREFORE, IT EXPECTS THAT THE DESIGN OF THIS ENVIRONMENT WILL BE GUIDED BY THREE MAJOR CRITERIA; BEAUTY, FUNCTION, AND EFFICIENCY. IT ALSO BELIEVES THAT A SATISFYING AND EXCITING VISUAL ENVIRONMENT CAN BE ACHIEVED ECONOMICALLY AND WITHOUT LOSS OF FUNCTION IF THE PLANNING IS CAREFUL AND THE DESIGNER IMAGINATIVE. ACCORDINGLY, IT IS EXPECTED THAT ALL THOSE INVOLVED IN THE PLANNING AND DESIGN OF SPECIFIC CAPITAL PROJECTS WILL STRIVE TO ACHIEVE THESE OBJECTIVES.

FURTHERMORE, A BUDGET OF TARGET COST FIGURE ESTABLISHED FOR A PROJECT IS TO BE RECOGNIZED AS AN UPPER LIMIT AND EVERY EFFORT MUST BE MADE WITHIN THE ABOVE POLICY TO DESIGN AND CONSTRUCT BELOW THIS FIGURE, WITH SURPLUS FUNDS THEN BEING AVAILABLE FOR OTHER PROJECTS.

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* Source: The University of Alberta Manual of Administrative Policy and Procedures, 1970.

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